







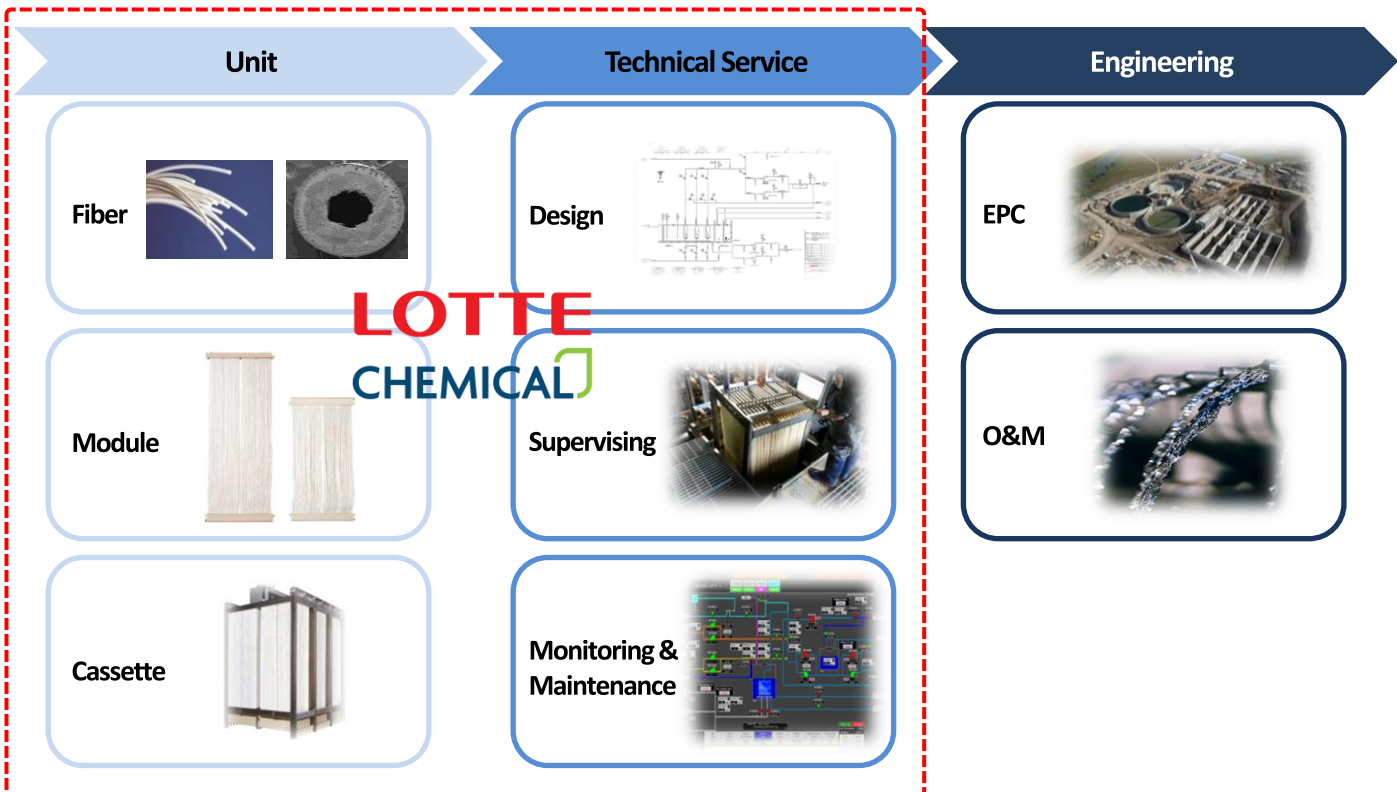
Introduction of the **LOTTE CHEMICAL** Submerged Membrane Technology

Overview

 Foundation <u>1976</u>	 Revenue (As of 2017) <u>\$15.9 B</u>	 Operating income (As of 2017) <u>\$2.9 B</u>
 No. of subsidiaries <u>32</u>	 No. of nation of progress <u>14</u>	 No. of employees <u>3,161</u>

Water Treatment Business Area

- Systems including fiber, module and cassette
- Technical service such as process design, technical support, monitoring & follow-up management

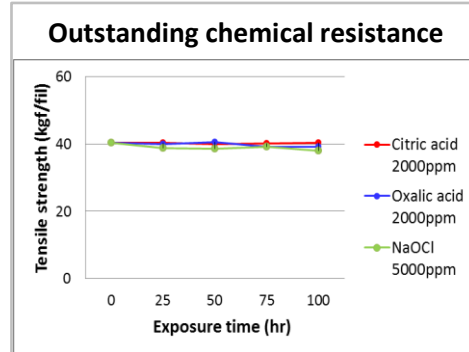
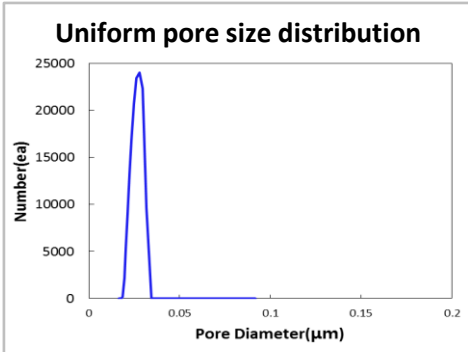


LOTTE CHEMICAL Membrane : Fiber

Membrane properties

<p>High tensile strength</p> <ul style="list-style-type: none"> Reduction in membrane breakage 	<p>High permeability</p> <ul style="list-style-type: none"> Less footprint Minimized TMP 	<p>Finer pore size</p> <ul style="list-style-type: none"> Fouling-resistant Safe quality of treated water 	<p>Cross-sectional View</p>
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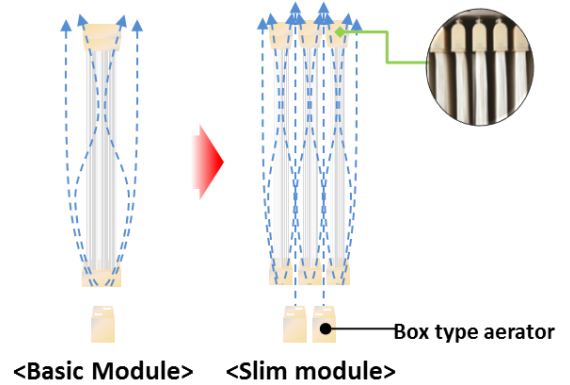
Specification	
Material & Type	
PVDF, Submerged hollow fiber	
I.D. / O.D (mm)	0.8 / 2.1
Nominal pore size (μm)	0.03
Permeability (LMH)	> 400
Tensile strength (kg _f /cm ²)	> 40
Operating Temp. (°C)	1 - 40
Operating pH	2 - 10.5



LOTTE CHEMICAL Membrane : Module & Cassette

Application of slim type module → high packing density cassette

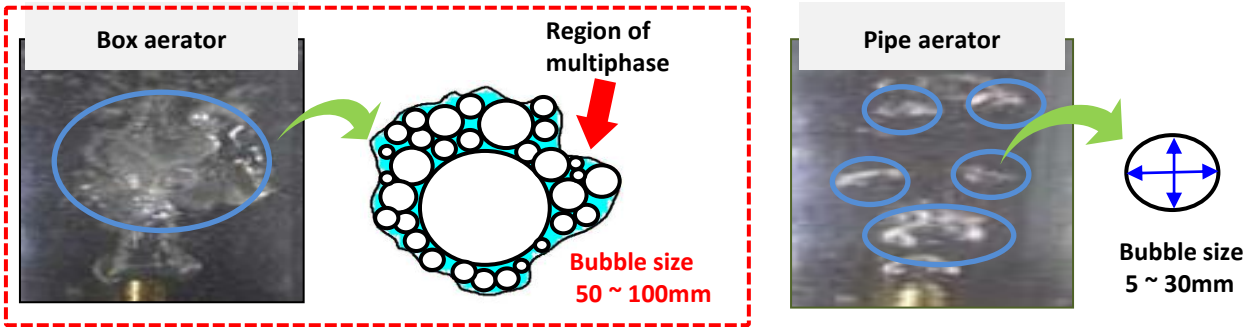
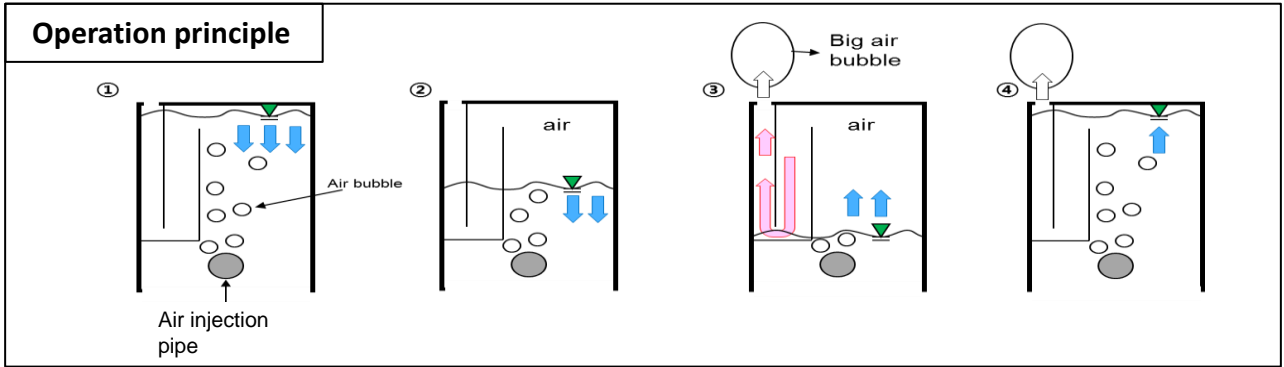
<p>Optimized Air-path</p> <ul style="list-style-type: none"> Reinforce air cleaning effect Lower energy consumption <p>Effective Air Scouring</p>	<p>Minimizing sludge inside module</p> <ul style="list-style-type: none"> Reinforce air cleaning effect Operating stability <p>Slim Header</p>
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Module type	Basic	Slim
Module header width (mm)	50	33
Max. No. of Air path (per cassette)	50	80
Max. No. of module (per cassette)	48	78
Max. membrane area (m ² /cassette)	1,632	1,856

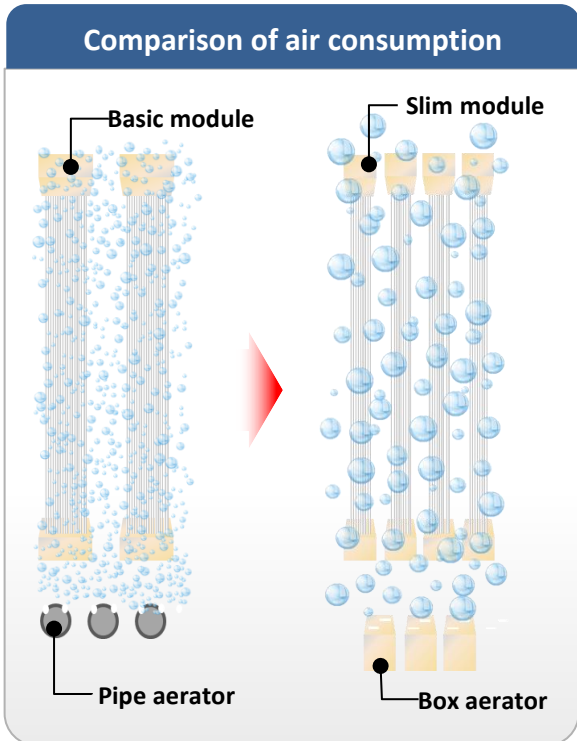
LOTTE CHEMICAL Membrane : Aerator

- BOX aerator : High efficient cleaning with minimum amount of air (Low energy process)



- High effect of physical cleaning with generation of large air bubbles (> 50mm)

LOTTE CHEMICAL Membrane : Module & Aerator



Demanded air flow	SADm (m ³ /m ² ·hr) ¹⁾
Pipe aerator	0.2 - 0.26
Box aerator	0.1 - 0.15

¹⁾ The results on the table are based on the normal operation for MBR

Test result	Air flow rate ²⁾ (m ³ /m ² /hr)	Critical Flux ₂₀ (LMH)
Basic module + Pipe aerator	0.19	32
Slim module + Box aerator	0.11	30

²⁾ The result on the table are based on pilot test performed by LOTTE

Increase of air integration

- Generate **big air bubbles**,
- **Increase releasing and rising velocity of bubble**,
- **maximize cleaning effects**

✳ Rise velocity of bubble ∝ shearing force

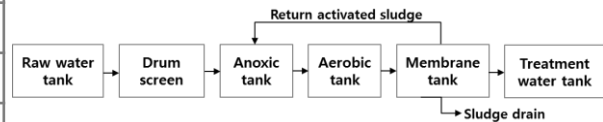
Evaluation of long-term operation of MBR under high flux for sewage treatment

- Stable operation in high flux condition for 10 months and without recovery cleaning for 6 months
- Stable water quality and quantity

Item	Content
Operation Duration	'17.11~Present
Installation Place	D Sewage Treatment
Raw Water	Sewage
Treatment Capacity	150m ³ /d
Membrane manufacturer	
Membrane Product (Model)	MEMBRIO SHC-S13M
Membrane area	309.4m ²
Operation Flux	31L/m ² ·h
MLSS	7,000 ~ 10,000mg/L
Aeration	0.12dm ³ /m ² ·hr



<Daegu, Seobu Sewage Treatment, MBR Pilot Plant>

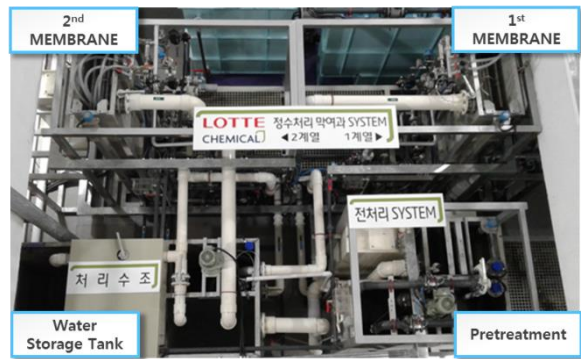


<MBR Pilot Plant Process Configuration>

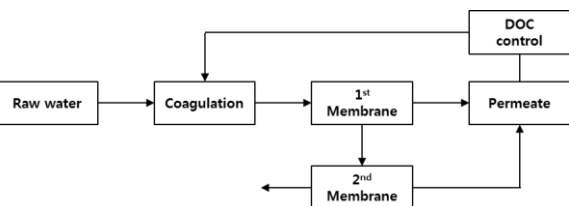
<Summary of Pilot system>

High recovery 2nd membrane system for drinking water

- Development of 2nd stage membrane system with 99% of water recovery
- Optimization of coagulation pretreatment system by control of permeate DOC(dissolved organic carbon)



<Pilot view of submerged membrane system>



<Pilot Plant Process Configuration>

Item	Content
Operation Duration	'18.01.24 ~ Present
Installation Place	O water-intake station
Raw Water	Reservoir
Treatment Capacity	150m ³ /d
Membrane manufacturer	
Membrane Product (Model)	MEMBRIO SHC-N03W
Membrane area	1st membrane : 101.4m ² 2nd membrane : 33.8m ²
Operation Flux	42L/m ² ·h

<Summary of Pilot system>