



KOLON MEMBRANE

Total Water Solution-Membrane Technology

High Permeability / High Stability / High Durability
Braid Reinforced PVDF Hollow Fiber Membrane



TECH VISION INC. Membrane Engineering & Sales

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We will lead global membrane filtration technology by developing differentiated membrane material technology and new environmental technology.



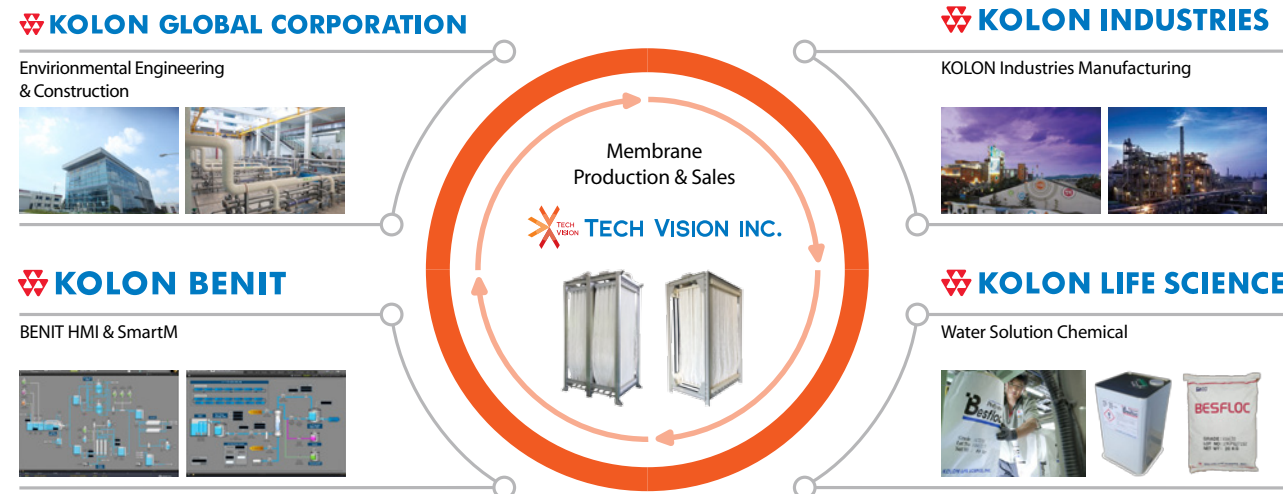
KOLON provides a comprehensive value-chain from core material production to new technology development/planning, construction, and operation, which are key elements of the water industry.

Tech Vision Co., Ltd., which carries out KOLON's membrane business, has established an integrated system to connect and supply core materials/systems for membranes.

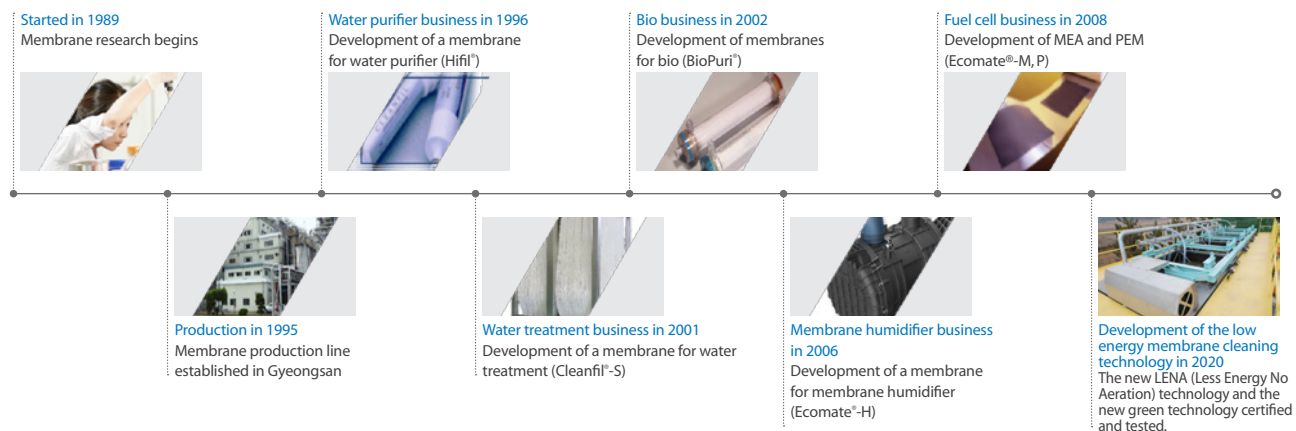
Based on this, Tech Vision Co., Ltd. will lead the membrane technology at home and abroad and go beyond Korea to grow into a world-class membrane manufacturer.



KOLON provides optimized integrated services through the cooperative synergy among its subsidiaries.



We produce core materials for membranes with technology that we have accumulated over thirty years.



Introducing Cleanfil[®]-S Reinforced Membrane

High-strength, high-performance, and eco-friendly PVDF (Polyvinylidene Fluoride) hollow fiber membrane

Membrane Features

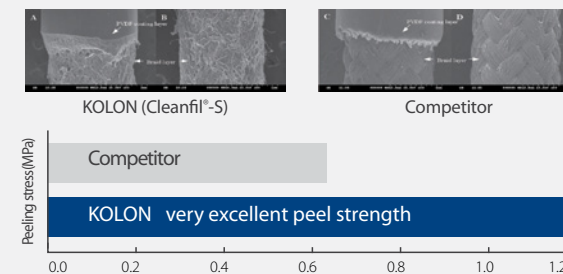
- Excellent mechanical strength and durability**
Cleanfil[®]-S is a composite hollow fiber membrane coated with a membrane layer on a high-strength reinforcing material. It boasts strong acidity to prevent fouling and excellent performance in the horizontal reciprocating process.
- Stable treatment performance**
The uniform membrane pore diameter ensures stable operation regardless of the quality of raw water, and the quality and quantity of treated water are excellent.
- Excellent stain resistance**
The membrane replacement cycle has been extended by strengthening the stain resistance with a specialized pore size.
- Easy handling**
It is a dry membrane that is not wetted and can be used immediately without additional chemical treatment. So, it is easy to transport and handle. The membrane module is designed to be easily attached or detached, so the maintenance of each single module is convenient.

The Structure and Features of the Membrane



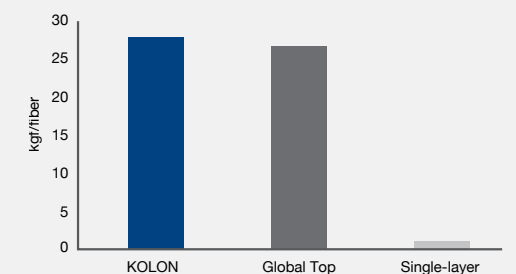
High-strength PVDF-coated membrane

200% better than the global top in peel strength



Excellent tensile strength

25kgf/fiber (single-layer membrane 1kgf/fiber)



Specifications of Cleanfil[®]-S reinforcing membrane

Classification	Detail
Manufacturer	Tech Vision Co., Ltd.
Material	PET + Polyvinylidene Fluoride (PVDF)
Type	Composite hollow fiber membrane
Inner/outer diameter	0.8/2.0mm
Pore size	0.1μm

Classification	Detail
Flux	0.36 ~ 1.68m ³ /m ² ·day
TMP	0.1 ~ 0.5kgf/cm ²
Tensile strength	Min. 25kgf/fiber
Applicable temperature	Max. 40°C
Applicable pH	2 ~ 10
Chemical resistance	Excellent

KOLON Membrane Portfolio

Specifications of Cleanfil®-S Module & Skid Frame

Cleanfil®-S20H



Module	S20H-20C					
Pore size	0.1µm					
Surface Area	20m²					
Width	1,185mm					
Length	105mm					
Height	626mm					
Material	ABS					
Dry weight	13.8kg					
Filter flow rate	0.2~0.8m³/hr					

SKID						
No. of modules	4EA	10EA	8EA	20EA	12EA	30EA
Surface Area	80m²	200m²	160m²	400m²	240m²	600m²
Width	555mm	1,185mm	555mm	1,185mm	555mm	1,185mm
Length	1,250mm	1,250mm	1,250mm	1,250mm	1,250mm	1,250mm
Height	1,354mm	1,354mm	1,947mm	1,947mm	2,540mm	2,540mm
SKID Material	STS 304					
Aerator	Included					

* The skid size can be changed according to site conditions.

Cleanfil®-S30V



Module	S30V-36B					
Pore size	0.1µm					
Surface Area	36m²					
Width	1,070mm					
Length	49.5mm					
Height	2,380mm					
Material	PVC					
Dry weight	15kg					
Filter flow rate	0.4~1.45m³/hr					

SKID						
No. of modules	12EA			20EA		
Surface Area	430m²			720m²		
Width	1,111mm			1,687mm		
Length	1,288mm			1,288mm		
Height	2,837mm			2,837mm		
SKID Material	STS 304					
Aerator	Included					

* The skid size can be changed according to site conditions.

Cleanfil®-S40V



Module	S40V-22A					
Pore size	0.1µm					
Surface Area	22m²					
Width	698.5mm					
Length	50.5mm					
Height	2,345mm					
Material	PVC					
Dry weight	9.2kg					
Filter flow rate	0.4~1.6m³/hr					

SKID						
No. of modules	38EA			70EA		
Surface Area	836m²			1,540m²		
Width	1,510mm			1,526mm		
Length	1,250mm			2,100mm		
Height	2,774mm			2,794mm		
SKID Material	STS 304					
Aerator	Included					

* The skid size can be changed according to site conditions.

Basic Engineering Data

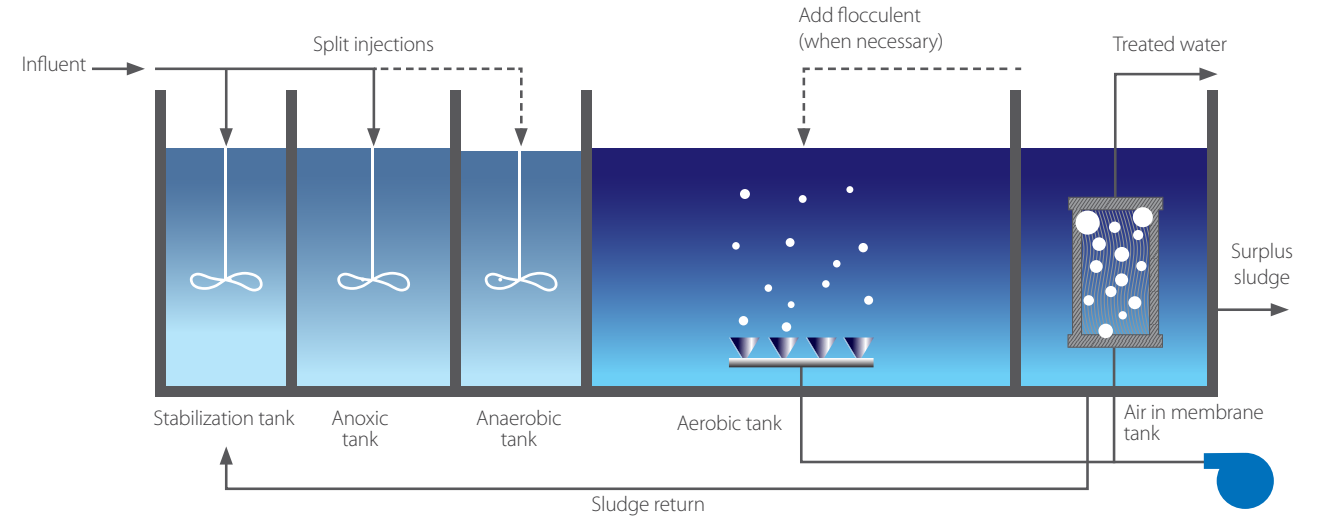
Item	Value
Design Flux	15~40LMH
Maintenance cleaning (organic)	Agent: Sodium hypochlorite Concentration: 200~500mg/L
Maintenance cleaning (inorganic)	Agent: Citric acid, oxalic acid Concentration: 200~1,000mg/L

Item	Value
Cleaning Air	0.003~0.01Nm³/min-m²
Recovery cleaning (organic)	Agent: Sodium hypochlorite Concentration: 2,000~3,000mg/L
Recovery cleaning (inorganic)	Agent: Citric acid, oxalic acid Concentration: 3,000~15,000mg/L

Sewage & Wastewater Treatment Methods

The KIMAS (Kolon Immersed Membrane Activated Sludge) Process

KIMAS-MBR Process Chart



Advantages of the KIMAS-MBR Process

- Maximized used of carbon sources**
 The anoxic tank placed before the anaerobic tank allows preferential use of organic matter in sewage, and maximizes the denitrification efficiency by distributing and injecting the influent into the anoxic tank.
- Minimized effect of dissolved oxygen**
 The effect of highly-concentrated dissolved oxygen in the return line on the anoxic tank is minimized by installing a stabilization tank.
- Reduced air consumption**
 The total amount of air consumption has been reduced by adopting dual system with the aerobic tank and the membrane tank. Fine bubbles are injected into the aerobic tank, and coarse bubbles are injected into the membrane tank.
- Convenient maintenance**
 Unmanned and automated operation of the entire processes keeps the process maintenance convenient.



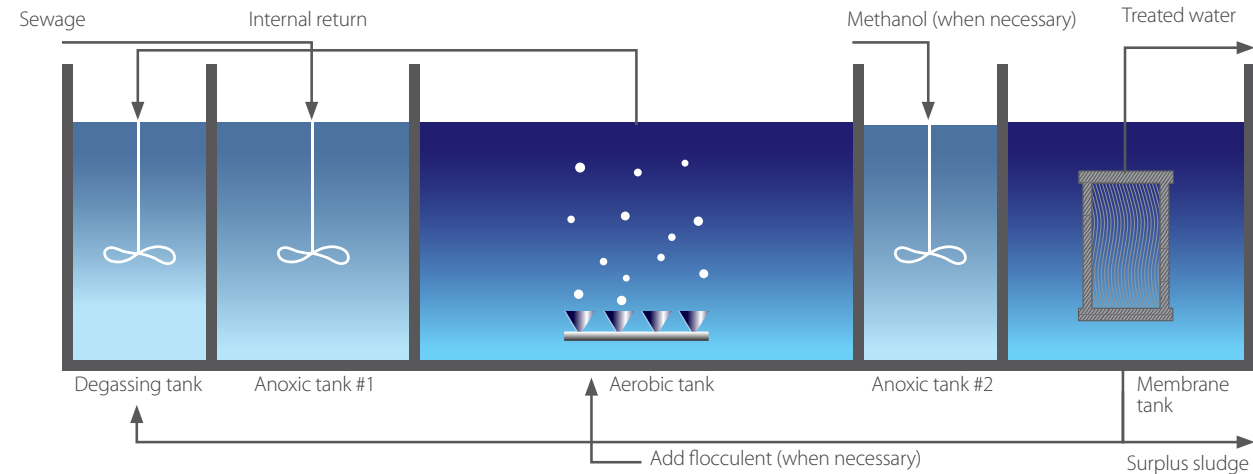
Quality of the Water Treated with the KIMAS-MBR Process

Classification	Influent	Treated water	Treatment ratio (%)
BOD (mg/L)	150.4 (102~204)	0.7 (0.2~1.9)	99.5 (98.7~99.9)
COD _{Mn} (mg/L)	68.6 (54.1~95.8)	6.5 (4.1~7.9)	90.3 (87.1~93.5)
COD _{Cr} (mg/L)	243 (198~329)	16.7 (11.1~23.6)	93.0 (89.5~96.6)
SS (mg/L)	92.7 (54~118)	0.05 (0.04~0.05)	99.9 (99.9~100)
T-N (mg/L)	45.8 (35.6~57.6)	7.3 (4.1~9.1)	83.9 (81.1~88.9)
T-P (mg/L)	-	3.15 (0.2~5.8)	58.4 (24.5~82.2)
	Add flocculent	0.57 (0.16~1.25)	91.2 (82.6~98.1)
Total E. Coli [Coliform (MPN / 100mL)]	5.52x10 ⁴ (0.18x10 ⁴ ~19.0x10 ⁴)	0.5 (0.0~5.0)	99.99 (99.8~100)

Sewage & Wastewater Treatment Methods

The I³ (Innovation of Process / Product / O&M) Process

I³ System Flow Chart



Advantages of the I³ System

- Maximized nitrogen removal**
 The nitrogen removal efficiency is improved by dualizing the anoxic tank and placing a degassing tank before it.
- Minimized air volume**
 The required air volume is minimized by dividing the aerobic zone into an aerobic tank and a membrane tank.
- Efficient use of carbon sources**
 It is designed to use the carbon sources necessary for denitrification by introducing raw water into anoxic tank #1.
- Convenient maintenance**
 The operation management system includes an on-line simulator and process diagnosis for convenient process maintenance.



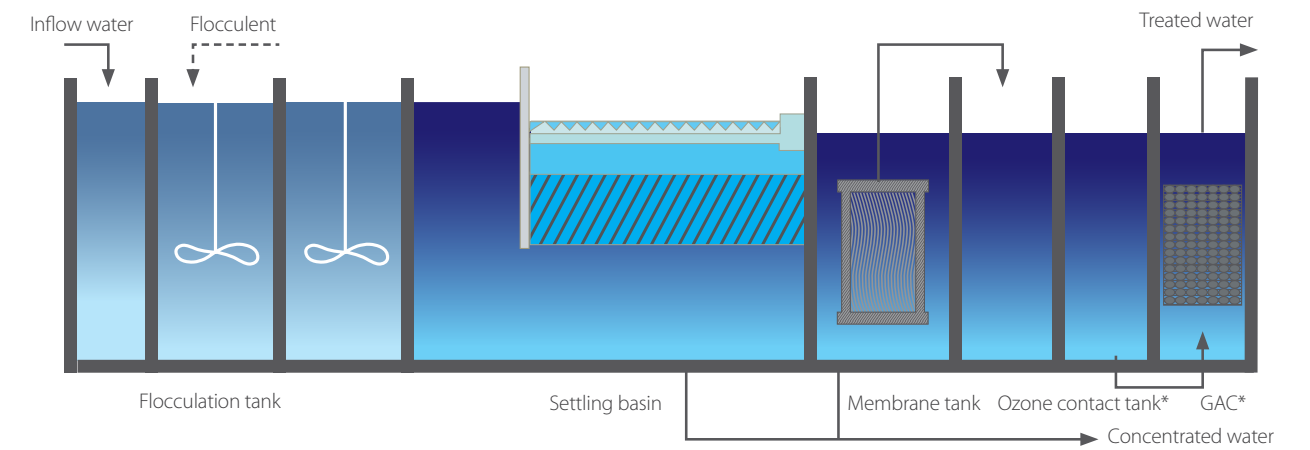
Quality of Water Treated with the I³ System

Classification	Influent		Treated water		Treatment efficiency (%)
	Range	Average	Range	Average	
BOD (mg/L)	5.0 ~ 147.0	89	N.D ~ 1.6	0.7	98.5
COD _{mn} (mg/L)	40.78 ~ 77.00	61.83	3.73 ~ 5.63	4.84	92.1
COD _{Cr} (mg/L)	200.00 ~ 927.14	406.77	18.13 ~ 92.80	41.96	88.8
SS (mg/L)	59 ~ 100	77	0.00 ~ 1.20	0.12	99.8
T-N (mg/L)	17.61 ~ 36.10	29.09	4.76 ~ 9.24	7.54	73.7
T-P (mg/L)	2.028 ~ 4.100	3.311	0.030 ~ 0.343	0.108	96.5
Total E. Coli. (number/100mL)	4,100,000 ~ 73,000,000	19,170,000	N.D ~ 24	2.23	100

Water Purification Methods

The K²IMAS (Kolon-Kwater Immersed Membrane Advanced System) Process

The K²IMAS Flow Chart



Advantages of the K²IMAS Process

- Minimized installation area**
 The required site area can be minimized compared to the existing water treatment processes by compactly configuring the membrane facility.
- Economical retrofitting of existing processes**
 When improving existing facilities, the membrane facilities can be installed in a filtration basin or a settling basin, thus eliminating the need for a separate site for the membrane process and minimizing the construction.
- Variety of process configurations**
 It is easy to customize the combination of a dust treatment facility and a downstream advanced treatment facility according to the target water quality. The high-efficiency settling basin can reduce the load of the solids on the membrane, and the adoption of ozone and GAC can effectively remove taste, odor substances, and soluble organic substances.
- Reduced maintenance cost**
 Air consumption can be reduced by changing the amount of aeration and aeration method according to the properties of raw water.



Quality of the Water Treated with the K²IMAS Process

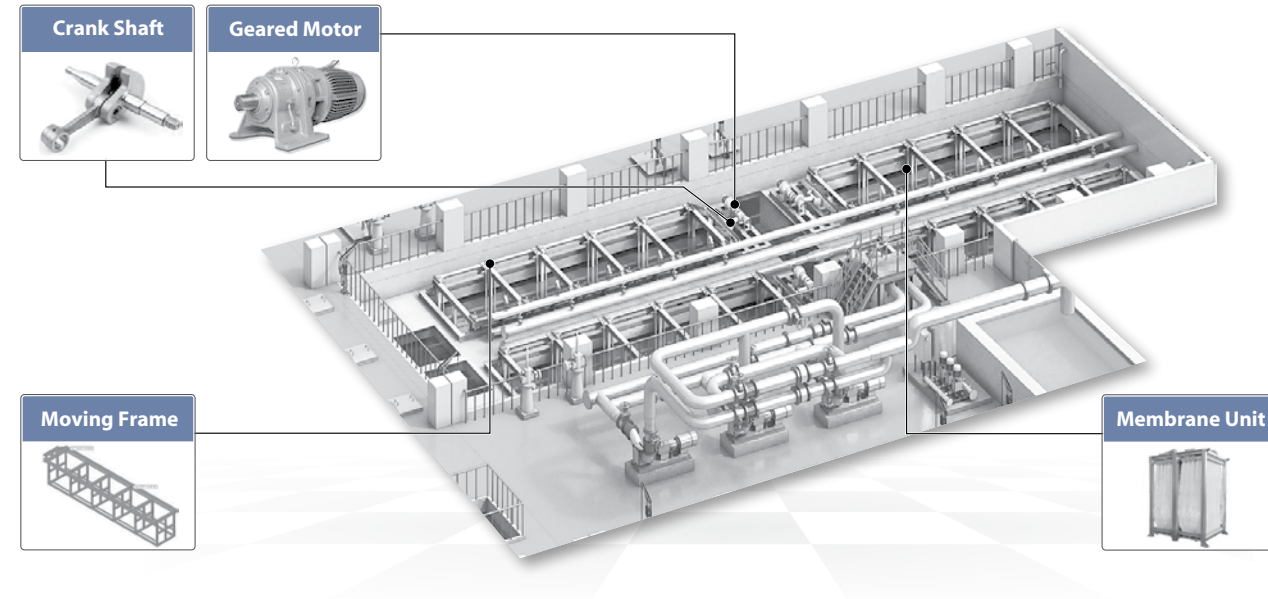
Classification	Treated water	Classification	Treated water
Bacteria	>4-log removal	TOC*	30~70% Removal
Cryptosporidium	>4-log removal	Manganese*	<0.02mg/L
Giardia	>4-log removal	Iron*	<0.05mg/L
Turbidity	<0.1 NTU	Color*	<5 PCU
TSS	<1mg/L		

*The removal of TOC, manganese, iron, and color may vary depending on the quality of the raw water, and in some cases, a pretreatment process is required.

LENA (Less Energy No Aeration)

An advanced sewage treatment technology that uses a horizontal reciprocating device to reduce the power consumption for membrane cleaning

The LENA Process Configuration



Advantages of the LENA Process

• Excellent economic efficiency

The aeration-free membrane cleaning technology reduces the energy consumption by more than 80% compared to the existing air cleaning methods.

• Convenient operation

It is a flexible technology that allows you to select the operation of the membrane tank under the aerobic or anoxic condition depending on the influent water. In addition, convenience has been increased by improving the cleaning cycle with the excellent membrane contamination removal ability.

• Excellent stability

A high MLSS concentration is possible, and the possible membrane damage caused by the blockage of the aerator is fundamentally blocked.



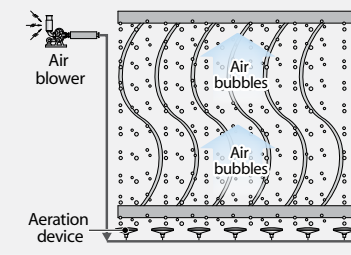
Quality of the Water Treated with the LENA Process

Classification	Influent		Treated water		Treatment efficiency (%)	
	Range	Average	Range	Average	Range	Average
BOD (mg/L)	70.0~180.0	134.2	0.2~2.2	1	97.2 99.8	99.2
COD _{mn} (mg/L)	11.6~75.6	54.1	0.5~8.0	3.3	84.6 97.7	93.8
SS (mg/L)	115.0~290.0	184	0.0~1.2	0.4	99.2 100.0	99.8
T-N (mg/L)	18.6~48.9	34.8	2.5~9.7	5.8	75.6 91.4	83.7
T-P (mg/L)	2.35~8.03	4.8	0.30~1.14	0.65	60.0 93.5	85.7
Total E. Coli. (number/100mL)	25,000~143,500	55,459	<30	<30	-	-

The Membrane Cleaning Processes in Comparison

Widely-Used Air Cleaning

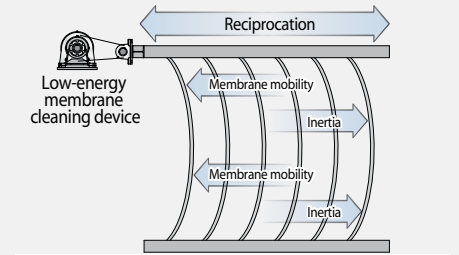
- ✓ **Mechanism**
Foreign substances are desorbed using shear force caused by coarse air bubbles that collide with the membrane surface.
- ✓ **Features of Widely-Used Air Cleaning**
 - Membrane contamination due to clogging of the aerator and the difference in hydraulic head
 - Insufficient cleaning due to non-uniform bubbles
 - Increased power cost and difficulty in applying high MLSS concentrations



<Operation simulation>

Low-Energy Membrane Cleaning

- ✓ **Mechanism**
Foreign substances are removed using the inertial force of the horizontal low-speed reciprocating device.
- ✓ **Features of Low-Energy Membrane Cleaning**
 - Membrane damage prevented by low-speed reciprocation
 - Increased membrane durability by maintaining low TMP
 - Energy cost reduction and high MLSS concentration possible

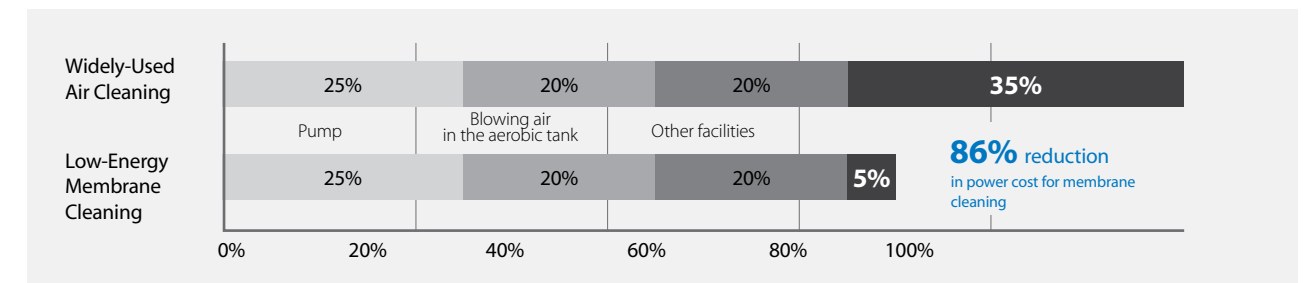


<Operation Simulation>

Upgrade

Energy Consumption and Eco-Friendly Benefits

Comparison of energy consumption by facility of the MBR process



The eco-friendly benefits of the low-energy membrane cleaning technology [10,000tons/day]

- Saved power [in electricity at KRW 80/kWh] → **876 MWh saved a year** → **KRW 70 million saved annually in power cost**
- Energy production [Ton of oil equivalent 0.215, USD 55/barrel, at KRW 1,120/USD] → **174 TOE produced a year** → **KRW 79 million saved annually in power production**
- Greenhouse gas reduction [at CO₂ emission factor of 0.495] → **434 tons of CO₂ reduced a year**

Cleaning technology	Cycle air cleaning	Pulse jet air cleaning	LENA
Wattage (kWh/m ³)	0.09	0.08	0.042

The above figures are representative values and may vary depending on the number of sources and the conditions for each site.

Intellectual Properties

Continuous technology development to ensure the best product performance



New Nechnologies

No.	Name of new technology	Type of new technology	Year & Month
1	Advanced sewage treatment technology using a removable membrane process with a built-in high-integration cassette-style module (New Excellent Technology Certification No.177 / New Excellent Technology Verification No.105)	KIMAS	Sep. 2007
2	Advanced sewage treatment technology using a hollow fiber membrane system and a two-stage anoxic tank (New Excellent Technology Certification No.308)	P System	Mar. 2010
3	Immersed membrane-based water purification technology using TIP slant board and batch filtration (New Excellent Technology Certification No.298)	K'IMAS	Dec. 2012
4	Advanced hollow fiber membrane sewage treatment technology that uses a horizontal reciprocating device to reduce membrane cleaning power consumption (New Excellent Technology Certification No.579 / New Excellent Technology Verification No.244)	LENA	Oct. 2020

Registered Patents

No.	Patent Name	Reg. No.
1	A composite hollow fiber membrane reinforced with knitted fabric	No. 0493113
2	Defect inspection device and inspection method for the hollow fiber membrane module	No. 0503622
3	A hollow fiber membrane module unit	No. 0509556
4	A hollow fiber membrane module	No. 0509557
5	Water treatment system and method	No. 10-0610251
6	An externally immersed biological membrane reaction tank with minimal aeration for membrane cleaning	No. 10-10-0649261
7	Immersed Hollow Fiber Membrane Module	No. 10-0705546
8	A hollow fiber membrane module and a filtration device equipped therewith	No. 10-0958785
9	A water treatment system using filtration membranes	No. 10-1993826
10	A water treatment system that uses the reciprocating motion of the filtration membrane and intermittent air cleaning	No. 10-2021951

Certificates

Intellectual property rights related to low energy: new technology certification and green technology certification and two other patents



Major Achievements

Membrane capacity installed by KOLON: about 500,000 tons per day in operation at more than 400 locations

Sewage & Wastewater Treatment Facilities



Administrative Complex City Water Quality Restoration Center A-2, 3
Beneficiary: Sejong City
Capacity: 60,000m³/day



Administrative Complex City Water Quality Restoration Center B
Beneficiary: Sejong City
Capacity: 30,000m³/day



Jeollanam-do Innovation City Water Quality Restoration Center
Beneficiary: Naju City
Capacity: 19,000m³/day



Jeollabuk-do Innovation City Water Quality Restoration Center
Beneficiary: Jeonju City
Capacity: 16,500m³/day



Siheung Mokgam Water Quality Restoration Center
Beneficiary: Siheung City
Capacity: 13,000m³/day



Guri Sewage Treatment Facility
Beneficiary: Guri City
Capacity: 26,000m³/day



Gumi Group-Wise Wastewater Treatment Facility
Beneficiary: KOLON Industries Co., Ltd.
Capacity: 10,000m³/day



KOLON Glotech Wastewater Treatment Facility
Beneficiary: KOLON Glotech Co., Ltd.
Capacity: 3,300m³/day



Muan Cheonggye Tertiary Treatment Facility
Beneficiary: Muan County
Capacity: 1,600m³/day

Water Purification Facilities



Yeongdeungpo Membrane Filtration Demonstration Water Purification Plant
Beneficiary: Seoul Metropolitan City
Capacity: 25,000m³/day



Gongsan Advanced Water Treatment (Membrane Filtration) Water Purification Plant
Beneficiary: Daegu Metropolitan City
Capacity: 40,000m³/day



Yeongju City Buseok Water Purification Plant
Beneficiary: Yeongju
Capacity: 2,100m³/day