

CLEANFIL™ Braid reinforced PVDF hollow fiber membrane
Total water solution technology



TECH VISION INC.



KOLON GLOBAL CORP.



We can Challenge the Global Top 10 Water Treatment Company in Our Outstanding Technologies.

KOLON has developed the product that can be applied to various fields such as industrial, Purifier, fuel cell, and bio pharmaceutical of membrane technology more than 25 years and from the development of processes and systems to the operation and management for water and wastewater treatment.

KOLON provides total water solution based on the unique membrane technology and up to the reuse of water integer, wastewater, the field of application are diverse.

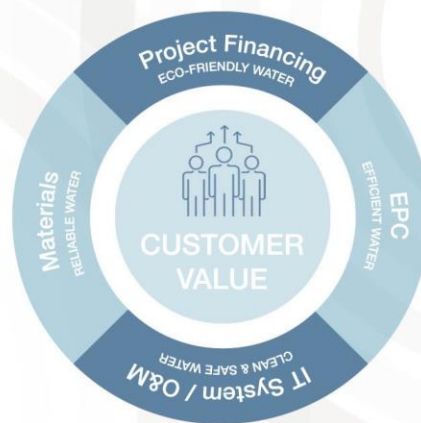
KOLON will continue to innovate with passion and unremitting efforts in order to leap into the world leader as a primary domestic leader.

Promote Synergy between KOLON Companies to Provide Total and Integrated Service.

KOLON INDUSTRIES

Membrane Production

KOLON Industries
Cleanfil™-S Membrane



TECH VISION INC.

KOLON GLOBAL CORP.

Membrane Engineering & Sales

Sewage / Wastewater / Drinking water treatment plant



IT System



KOLON BENIT

Monitoring System Cleanfil-M : Package System



Engineering & Equipment



KOLON Environmental Service

Membrane water treatment



KOLON e Eng.

DF, Plant water treatment



KOLON Fjord Processing

Oil / Gas plant eng.

Chemical



KOLON Life Science

Water treatment coagulant

Company Specializing in Membrane Technology

- Since the beginning of research on ultrafiltration in 1989, we have accumulated the related technologies for 29 years.
- Water purifier, bio-pharmaceutical, water treatment (drinking, wastewater), humidifier

Cleanfil™-S

WT/WWT, Reclamation and desalination(pre-treatment)
Long-term durability(Braid reinforced)

Cleanfil™

Water Purifier
Perfect removal of micro-particles and microorganisms

BioPuri™

Pharmaceutical and Bio-researching Products
Special grades of separation

Ecomate™

Humidifier and MEA Stack
Hydrogen fuel cell for vehicles & stationary generators



BioPuri bundle



Cleanfil™-S module



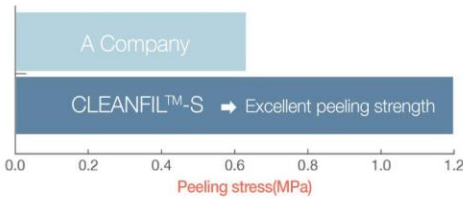
Ecomate module



Cleanfil™-S Reinforced Membrane Properties

- High-strength composite hollow fiber membrane developed by KOLON's own technology
- Coating layer : PVDF of sponge like structure with membrane function
- Peeling strength : Fibrous support layer with high mechanical properties

➔ **Excellent strength compared to competitors.**

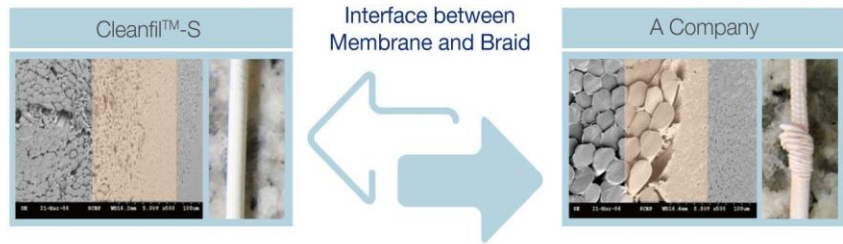


Membrane property

Membrane material	Braid material	ID / OD	Pore size	Pure permeability	Tensile strength
PVDF	PET	0.8/2.0 mm	0.1, 0.04 μ m	1080LMH at-100mmHg	>30 kg/fiber

Mechanical Strength of Cleanfil™-S

- Achieving the best anti-peeling strength in the world through effective diffusion of braid layer and membrane layer
- The possibility of water quality accident caused by separation of the membrane layer is 0%.

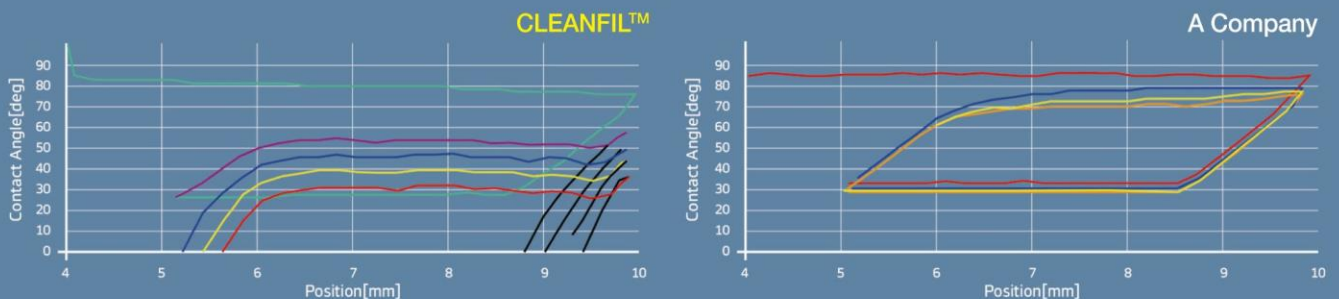


Wetting Agent Free Property

- Easy handling because no wetting agent is used
- Even used membrane can be stored in dry condition for up to 6 months after simple cleaning.

Sample	Permeability(LMH/bar)		
	Dry	Wet	Dry/Wet
Cleanfil™-S	900	1,080	83%
Third party	24	720	3%

- Contact angle analysis of KOLON membrane showed that more than 90% of hydrophilization was restored within 5 minutes : 50° ➔ 30°
- No change in contact angle analysis for third-party membranes.

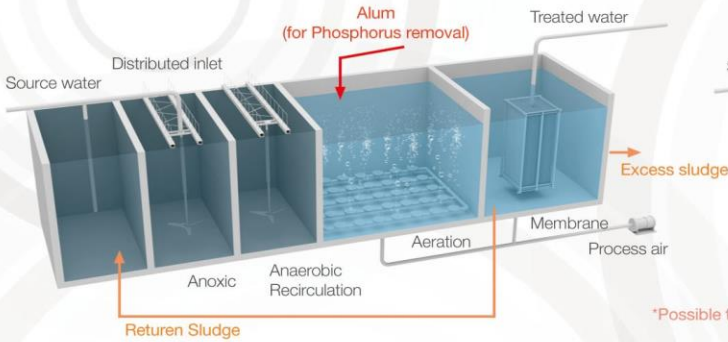


KOLON Membrane Process

KOLON membrane products compose of reinforced hallow fiber membrane made with PVDF (Polyvinylidene Fluoride) that has excellent fouling resistance, chemical resistance and mechanical strength. The membrane also has outstanding water permeability and regular removal performance. Accordingly, it can be applied to various water treatment system.

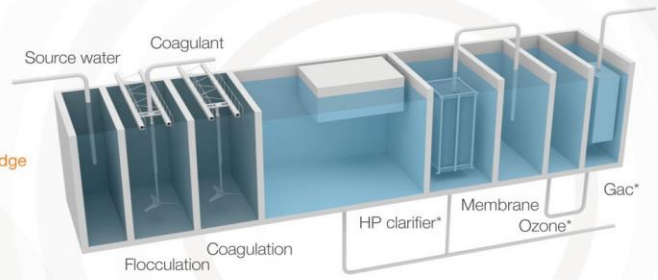
Wastewater Treatment Process

- Small footprint, easy operation, long SRT operation
- Stable water treatment



Drinking Water Process

- Resistant to water quality & quantity fluctuation
- Stable water treatment is possible even with the introduction of specific substances

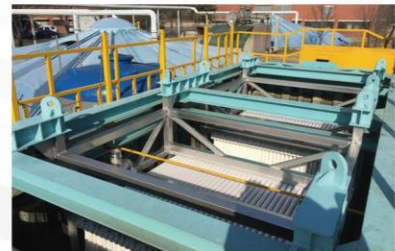
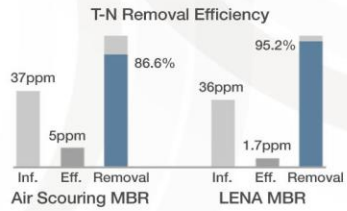


*Possible to alter according to source water characteristic and the objective quality of treated water

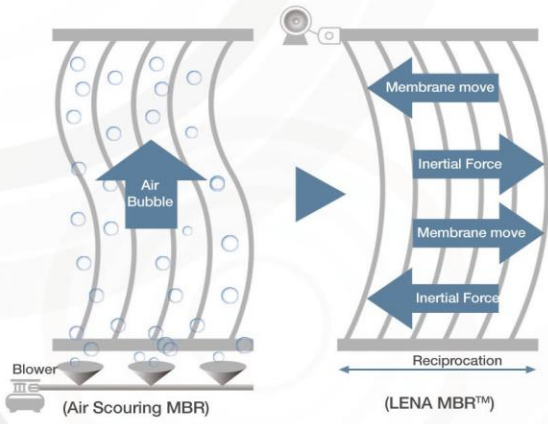
LENA (Less Energy No Aeration)

Higher Operating Flux	Power Consumption up to 75% saving	Improved Nitrogen Removal
-----------------------	------------------------------------	---------------------------

20~40LMH Operating Flux



How It works



Basic Engineering Data

Item	Value
Design Flux	15~40LMH
Maintenance cleaning (Organic)	Chemical type: Sodium Hypochlorite Concentration: 200~500mg/L
Maintenance cleaning (Inorganic)	Chemical type: Citric Acid, Oxalic Acid Concentration: 200~1,000mg/L

Item	Value
Cleaning Air	0.003~0.01Nm ³ /min·m ²
Recovery cleaning (Organic)	Chemical type: Sodium Hypochlorite Concentration: 2,000~3,000mg/L
Recovery cleaning (Inorganic)	Chemical type: Citric Acid, Oxalic Acid Concentration: 3,000~15,000mg/L

KOLON Membrane Product

Cleanfil™-S20H



Module	S20H-20C	S20H-20D
Pore size	0.1µm	0.04µm
Surface Area	20m ²	
Width	1,185mm	
Length	105mm	
Height	626mm	
Case material	ABS	
Dry weight	13.8kg	

SKID	S20H-20C□E041	S20H-20C□E101	S20H-20C□E082	S20H-20C□E202	S20H-20C□E123	S20H-20C□E303
Number of Modules	4EA	10EA	8EA	20EA	12EA	30EA
Surface Area	80m ²	200m ²	160m ²	400m ²	240m ²	600m ²
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 Frame material	STS 304					
Diffuser	Included					

*THE SKID specifications can be modified according to the site conditions.

□: C = S20H-20C, D = S20H-20D

Cleanfil™-S30V



Module	S30V-36B	S30V-36C
Pore size	0.1µm	0.04µm
Surface Area	36m ²	
Width	1,070mm	
Length	49.5mm	
Height	2,380mm	
Case material	PVC	
Dry weight	15kg	

SKID	S30V-36□F121	S30V-36□F201
Number of Modules	12EA	20EA
Surface Area	430m ²	720m ²
Width	1,111mm	1,687mm
Length	1,288mm	1,288mm
Height	2,837mm	2,837mm
SKID Frame material	STS 304	
Diffuser	Included	

*THE SKID specifications can be modified according to the site conditions.

□: B = S30V-36B, D = S30V-36B

Cleanfil™-S40V



Module	S40V-22A	S40V-22B
Pore size	0.1µm	0.04µm
Surface Area	22m ²	
Width	698.5mm	
Length	50.5mm	
Height	2,345mm	
Case material	PVC	
Dry weight	9.2kg	

SKID	S40V-22□A382	S40V-22□A702
Number of Modules	38EA	70EA
Surface Area	836m ²	1,540m ²
Width	1,510mm	1,526mm
Length	1,250mm	2,100mm
Height	2,774mm	2,794mm
SKID Frame material	STS 304	
Diffuser	Included	

*THE SKID specifications can be modified according to the site conditions.

□: A=S40V-22A, B=S40V-22B

Typical References

Sewage water



**Guri I³ System
Sewage Treatment Plant**
Client ----- Guri City
Capacity ----- 26,250m³/day



**Siheung Mokgam
Sewage Treatment Plant**
Client ----- Siheung City
Capacity ----- 13,000m³/day



**Sejong City
Sewage Treatment Plant**
Client ----- Sejong City
Capacity ----- 80,000m³/day

Drinking water



**Yeongdeungpo Drinking Water
Treatment Plant in Seoul**
Client ----- Seoul City
Capacity ----- 25,000m³/day



**Gongsan Drinking Water
Treatment Plant in Daegu**
Client ----- Daegu City
Capacity ----- 40,000m³/day



**Drinking Water Treatment Plant
in Nongfu, China**
Client ----- Nongfu Spring co., China
Capacity ----- 6,720m³/day

Industrial Wastewater



**Gumi K Factory
Wastewater Treatment Plant**
Client ----- K company
Capacity ----- 10,000m³/day



**Jeungpyeong Industrial Complex
Wastewater Treatment Plant**
Client ----- Jeungpyeong City
Capacity ----- 2,500m³/day



Jeonbuk Innovation City
Client ----- Jeonbuk City
Capacity ----- 15,000m³/day

Total Cumulative Sales Volume : 500,000m³/day (400 sites)

Year	Field name	Volume	Module qty	Type of raw
2010	Kolon waste water disposal	10,000	800EA	Industrial Wastewater
2011	Terminal disposal plant of sewage in Changwon	6,000	400EA	Sewage
2011	Chungju, Innovation City	5,500	480EA	Sewage
2012	Jeonnam, Innovation City	10,000	800EA	Sewage
2014	Jeonbuk, Innovation City	15,000	1,300EA	Sewage
2015	Happy City, Water Quality Restoration Center (B-1)	30,000	2,160EA	Sewage
Under construction	Happy City, Water Quality Restoration Center (A-2)	50,000	3,200EA	Sewage
Under construction	Waste water from Jeonbuk Iksan	10,000	800EA	Industrial Wastewater

 **TECH VISION INC. Membrane Engineering & Sales**

Kolon Tower 6F, Kolon-ro 11, Gwacheon-si, Gyeonggi-do (13837)

Tel : +82-2-3677-6380

Fax : +82-2-3677-6360

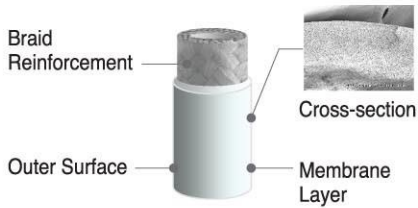
Mail : rush5@kolon.com

KOLON Cleanfil -S

Specialized to hollow fiber membrane since 1989

CLEANFIL®

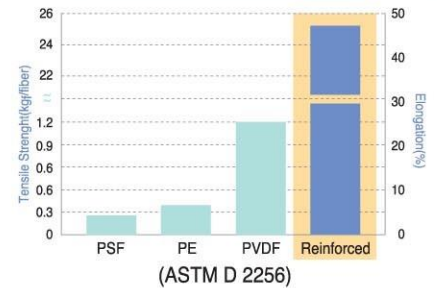
Membrane Structure



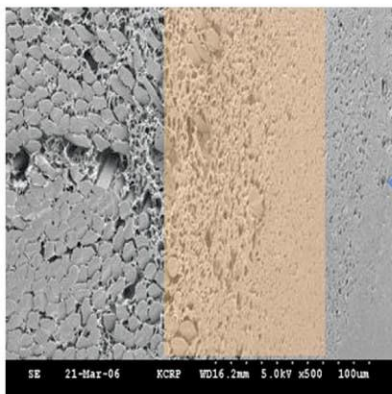
Membrane Specifications

Material	PVDF
Reinforcing Material	PET
ID / OD	0.8 / 2.0 mm
Pore size	0.1 μm , 0.04 μm
PureWater Permeability	425 LMH at-100mmHg
Tensile Strength	>25kg _f / fiber

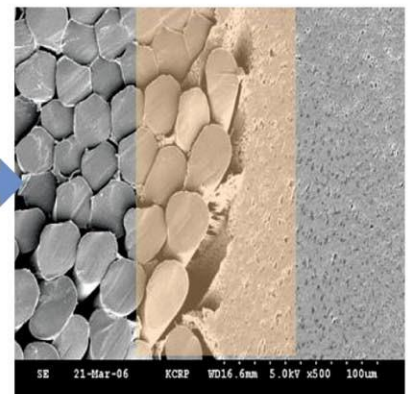
Tensile Strength



High Peeling Strength



Interface between membrane and braid

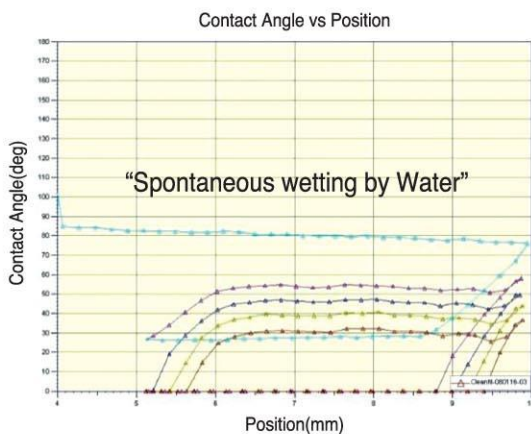


KOLON Membrane



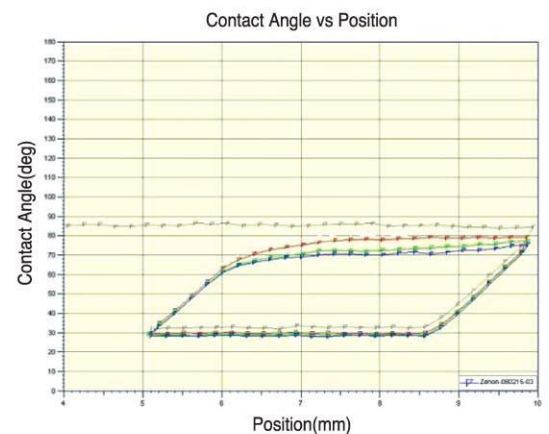
A Membrane

Wetting Agent Free



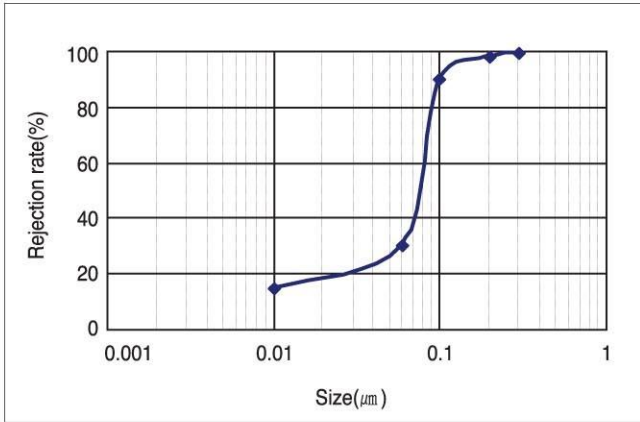
KOLON Membrane

Contact angle (By Kruss TensiometerK100)

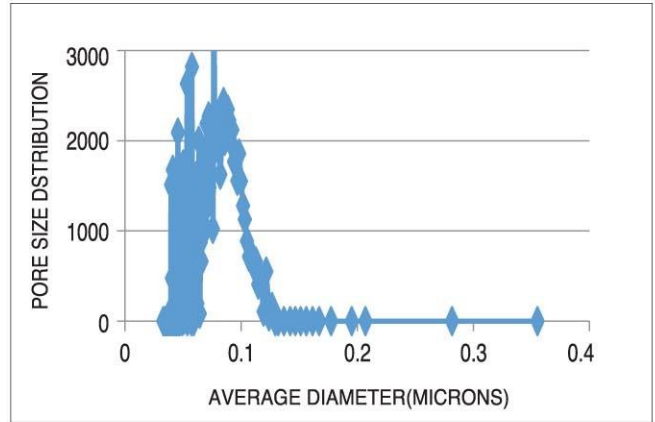


A Membrane

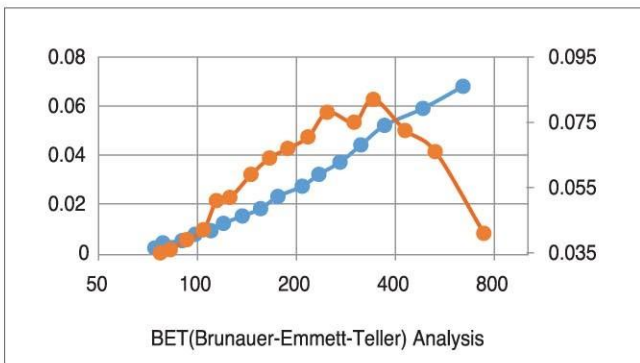
Pore Size Control Technology



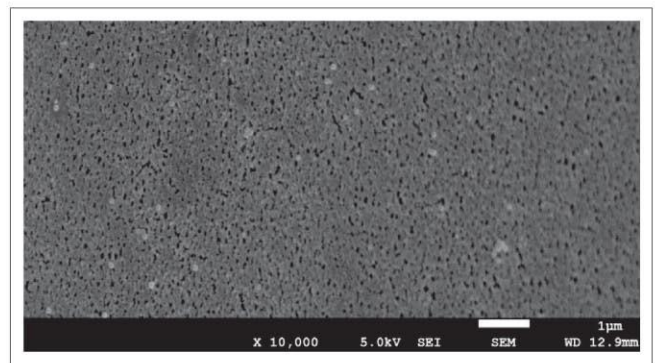
Bead rejection Test



PORE SIZE DISTRIBUTION



BET Analysis



SEM Analysis

Reinforced PVDF hollow fiber Membrane Property

Item	Treated Water	
	MF	UF
Pore size	0.1um	0.04um
Turbidity	< 0.1 NTU	< 0.1 NTU
SDI	< 3.5	< 2.5

KOLON Membrane Advantage

1 Long-term durability

- Mechanical durability
(Excessive Aeration, Swing, Particle, Physical stress, etc.)
: High tensile strength (Non-broken)
: Peeling strength (Non-peeled)
- Chemical durability
: Good resistance against chlorines, acids, and bases

2 Wetting agent free

- Easy installation
- Excellent handling at emergency

3 Reliable performance

- High rejection rate due to even pore structure
- High permeability
- Good anti-fouling property

4 Safety (Approval)

- Eco-friendly materials
- No wetting or No anti-oxidant agents included



TECH VISION INC.



KOLON GLOBAL CORP.

Advantages

1 High efficient aeration

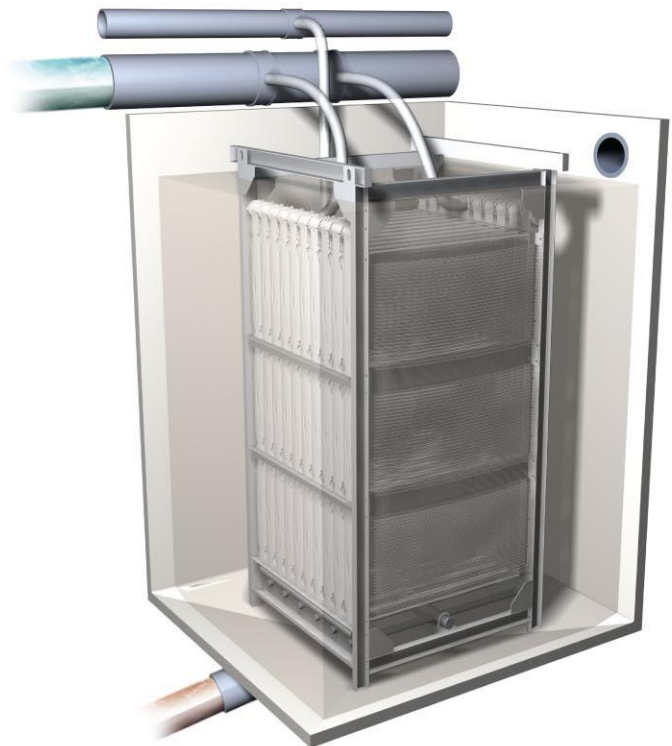
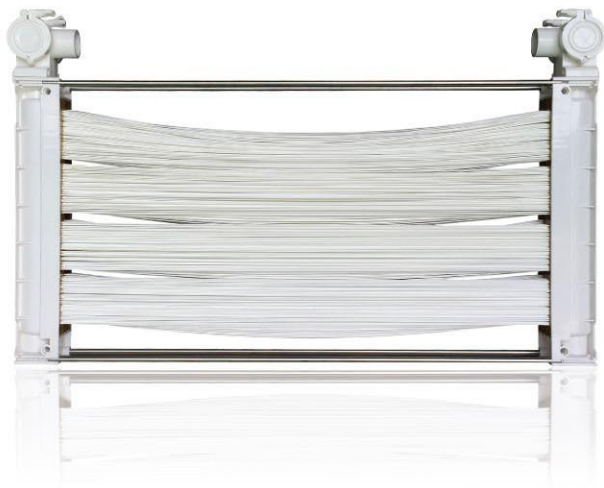
- Horizontal type
- Less operational cost due to optimization of horizontal structure
- Strong support for enhanced aeration

2 2-Dimensional free extension

- Flexible build-up to both length and height direction

3 Effective water permeation

- High packing density
- Dual suction



Yeongdeungpo, Seoul



DWT 25,000m³/day, 2010

Gongsan, Daegu



DWT 40,000m³/day, 2013

KOLON Cleanfil-S20H Line up

Module	S20H-20C	S20H-20D
Pore size	0.1 μ m	0.04 μ m
Surface Area	20m ²	
Width	1,185mm	
Length	106mm	
Height	628mm	
Case material	ABS	
Dry Weight	13kg	

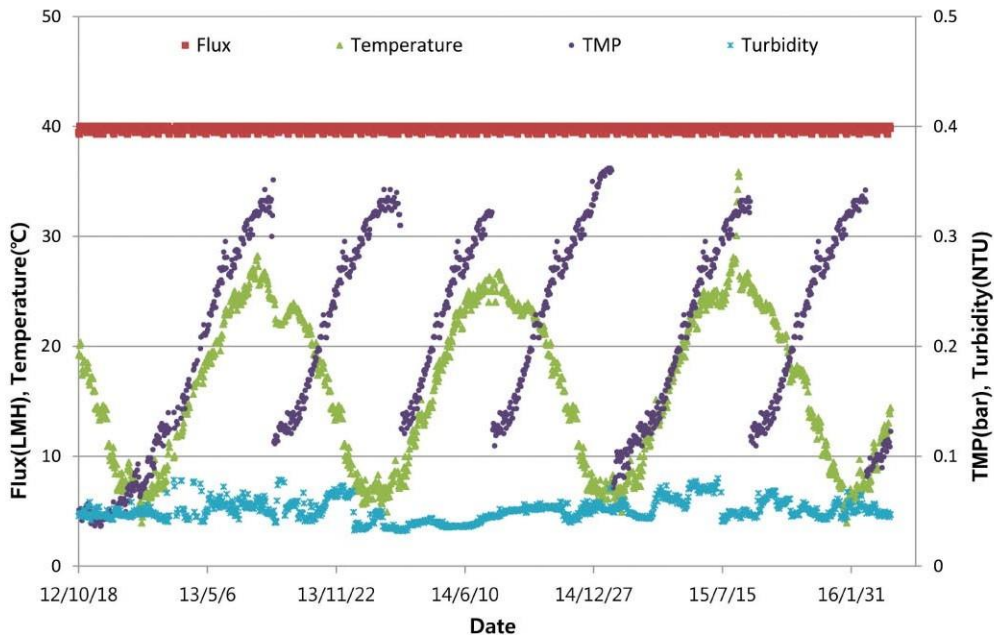
SKID	S20H-20□E041	S20H-20□E101	S20H-20□E082	S20H-20□E202	S20H-20□E123	S20H-20□E303
Number of Modules	4EA	10EA	8EA	20EA	12EA	30EA
Surface Area	80m ²	200m ²	160m ²	400m ²	240m ²	600m ²
Width	555mm	1,185mm	555mm	1,185mm	555mm	1,185mm
Length	1,250mm	1,250mm	1,250mm	1,250mm	1,250mm	1,250mm
Height	1,354mm	1,354mm	1,947mm	1,947mm	2,540mm	2,540mm
SKID Frame material	STS 304					
Diffuser	Included					

★THE SKID specifications above can be modified according to the site conditions. □ : C = S20H-20C, D = S20H-20D

Max.Operating Temp°C	40°C
Operating pH Range	5.0~9.5
Cleaning pH Range	2.0~10.5

Applications

Drinking water	Waste water	Sewage water	Industrial water	For Recycle	Wastewater Reuse
◎	○	○	×	◎	○



TECH VISION INC.



KOLON GLOBAL CORP.

Advantages

- 1 Easy maintenance**
 - Easy assembly of modules and diffusers
- 2 Anti-fouling property**
 - Vertical type membrane module & SKID
 - Effective air scouring
- 3 Effective water permeation**
 - Dual suction (Top & Bottom)



Guri, Gyeonggi



WWT 6,250m³/day, 2010 - WWT 20,000m³/day, 2013

Gumi (Kolon Ind.)



WWT 10,000m³/day, 2009

KOLON Cleanfil-S30V Line up

Module	S30V-36B	S30V-36C
Pore size	0.1 μ m	0.04 μ m
Surface Area	36m ²	
Width	1,069mm	
Length	49mm	
Height	2,395mm	
Case material	PVC	
Dry Weight	14kg	

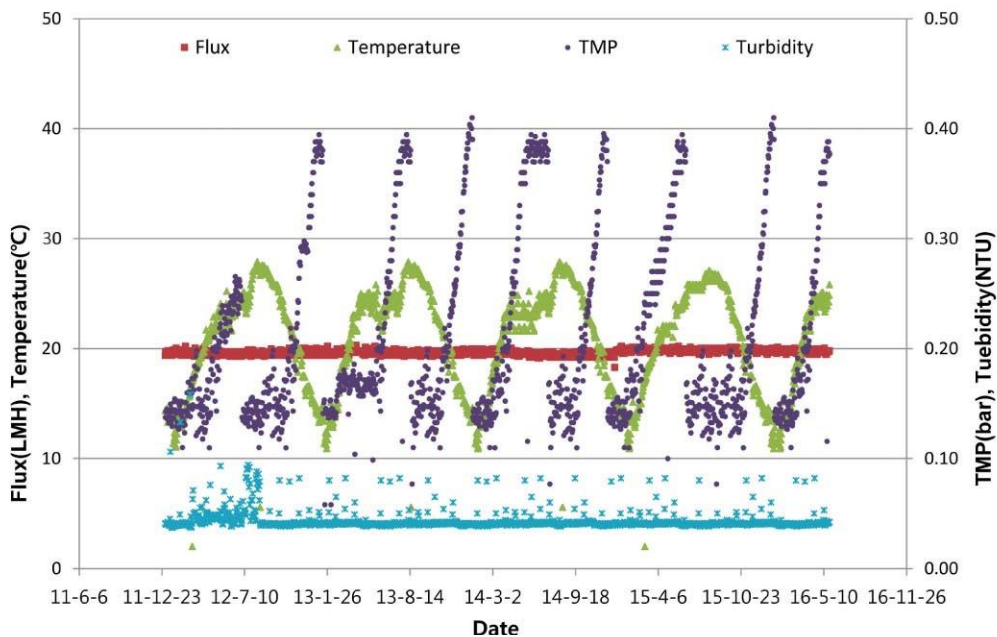
SKID	S30V-36 <input type="checkbox"/> F121	S30V-36 <input type="checkbox"/> F201
Number of Modules	12EA	20EA
Surface Area	430m ²	720m ²
Width	1,111mm	1,687mm
Length	1,288mm	1,288mm
Height	2,837mm	2,837mm
SKID Frame material	STS 304	
Diffuser	Included	

★THE SKID specifications above can be modified according to the site conditions. : B = S30V-36B, D = S30V-36B

Max.Operating Temp°C	40°C
Operating pH Range	5.0~9.5
Cleaning pH Range	2.0~10.5

Applications

Drinking water	Waste water	Sewage water	Industrial water	For Recycle	Wastewater Reuse
○	◎	◎	◎	○	○



TECH VISION INC.



KOLON GLOBAL CORP.

Advantages

1 Saving the cost

- The highest packing density & stable performance
- Reducing 30% air demand
- Increasing design flux

2 Replacement

- 1:1 Direct replacement of conventional cassette
- Single or double-deck system

3 High durability

- Swing, particle material, physical stress



Kolon Membrane is applied for Doosan LENA
(Low Energy No Aeration) MBR

KOLON Cleanfil-S40V Line up

Module	S40V-22A	S40V-22B
Pore size	0.1 μ m	0.04 μ m
Surface Area	22m ²	
Width	700mm	
Length	50mm	
Height	2,440mm	
Case material	PVC	
Dry Weight	9.5kg	

SKID	S40V-22 □ A382	S40V-22 □ A702
Number of Modules	38EA	70EA
Surface Area	836m ²	1,540m ²
Width	1,510mm	1,526mm
Length	1,250mm	2,100mm
Height	2,774mm	2,794mm
SKID Frame material	STS 304	
Diffuser	Included	

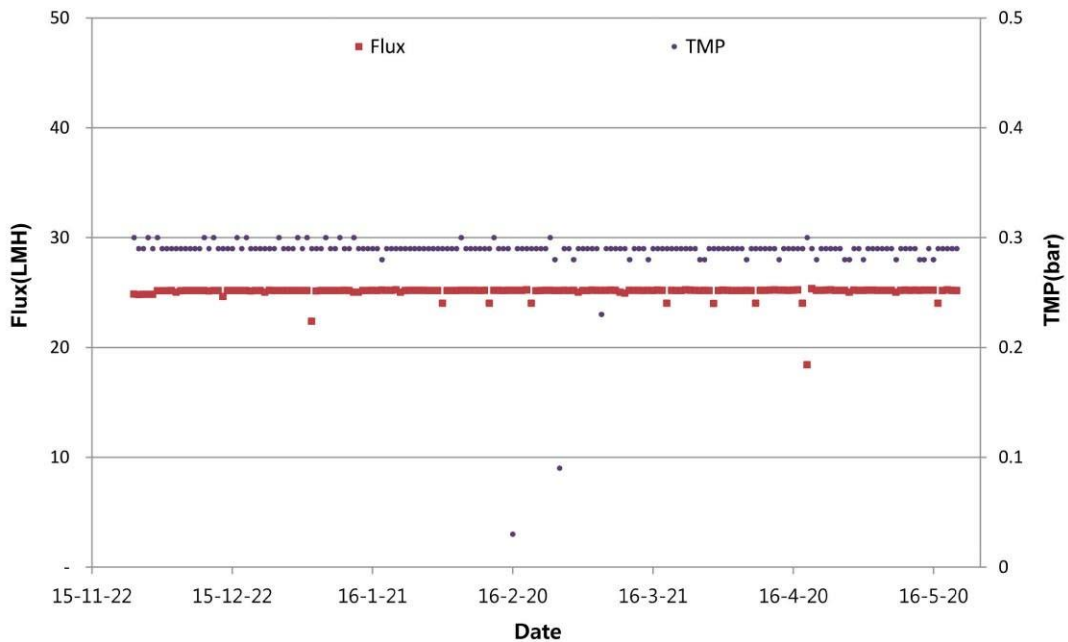
★THE SKID specifications above can be modified according to the site conditions.

□ : A = S40V-22A, B = S40V-22B

Max.Operating Temp°C	40°C
Operating pH Range	5.0~9.5
Cleaning pH Range	2.0~10.5

Applications

Drinking water	Waste water	Sewage water	Industrial water	For Recycle	Wastewater Reuse
○	○	○	○	○	○



TECH VISION INC.



KOLON GLOBAL CORP.

Cleanfil®

Hollow Fiber Membrane and Module for Residential Water Purifier

The hollow fiber membrane produced by Kolon industries is made

Excellent Water Permeability

The hollow fiber membrane inherently has higher hydrophilicity, which shows excellent permeate flux compare to other hollow fiber membranes having the same pore size.

Higher Selectivity

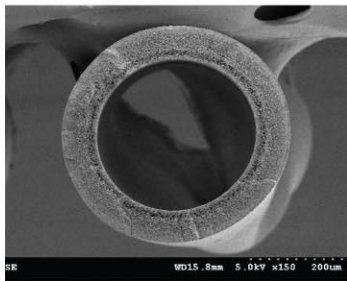
Narrow pore size distribution results in higher rejection coefficient against many kinds of impurities, and especially hollow fiber membrane was designed to have a sharp cut-off ability to reject microparticles and microorganisms.

High Temperature and Chemical Resistance

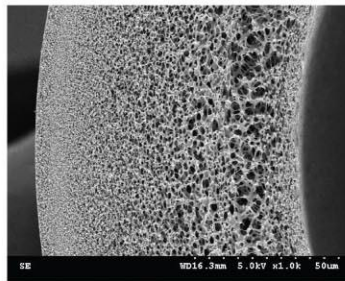
Because hollow fiber membrane is made of polysulfone, which is a high performance engineering plastic, it has high temperature resistance. It can be used in a process with elevated temperature and applicable to various chemical cleaning processes.

Various Application

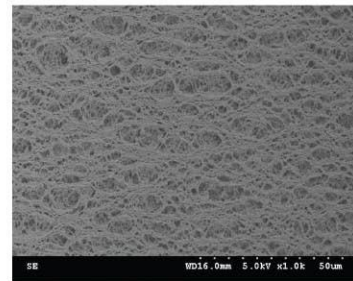
Cool/Hot water purifier, Built-in, Faucet-mounted, Counter-on(pot), Pitcher, Portable purifier, Gravity flow



Cross Section



Cross Section



Cross Section

Specifications

Specifications			Membrane
Dimensions(OD/ID)		μm	490 / 320
Liquid Permeability		ml /cm ² .min.kgf/cm ²	10.0
Protein Rejection	γ-Globulin	%	35 ↓
	Hemocyanin	%	90 ↑
Bacterial Removal (1.0×10 ⁴ CFU/ml)	E. Coli	%	100
	Pseudomonas	%	99.99
Flow Type		-	OUTSIDE→INSIDE

Module



Application



Well-designed Asymmetric Sponge-Like Structure

Integral microporous sponge-like support structure for outer thin separating layer. Macrovoid-free structure virtually eliminates the possibility of “pinhole” defects which are occurred in many membranes.

Sharp Molecular Weight Cut-off

Due to its Narrow Pore Size Distribution

Applicable to Almost Any Processing Requirements

Wide range of inner / outer diameter and MWCO

High Temperature and Chemical Resistance

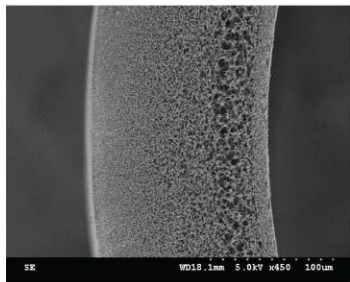
Because BioPuri is made of polysulfone / polyethersulfone, it has high temperature resistance and broad chemical compatibility.

Application

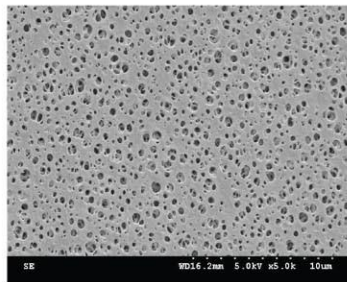
Concentration of a retained molecular species by the removal of a solvent

Desalting or buffer exchange by passing microsolute

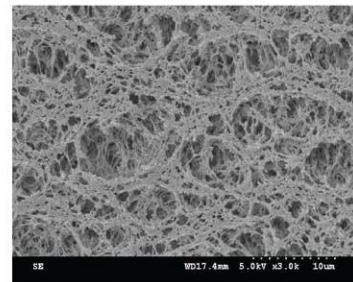
Fractionation or clarification by retaining larger species and passing smaller species



Cross Section



Cross Section



Cross Section

Specifications

Specifications		BS500	BES 0.2	BE 0.2	BE 0.5
General Properties of Fiber					
Material		Polysulfone	Polysulfone	Polyethersulfone	Polyethersulfone
Dimension (mm)	ID	1.0	0.5	1.0	1.0
	Thickness	0.15	0.08	0.15	0.15
Membrane Performance					
Permeability of pure water, Lp (ml/cm ² .min.kgf/cm ²)		0.75	10	15	14
MWCO(or pore size)		500,000	0.2μm	0.2μm	0.5μm
Product Specification					
Type		Bundle or Spool			

- Vary in Pore size

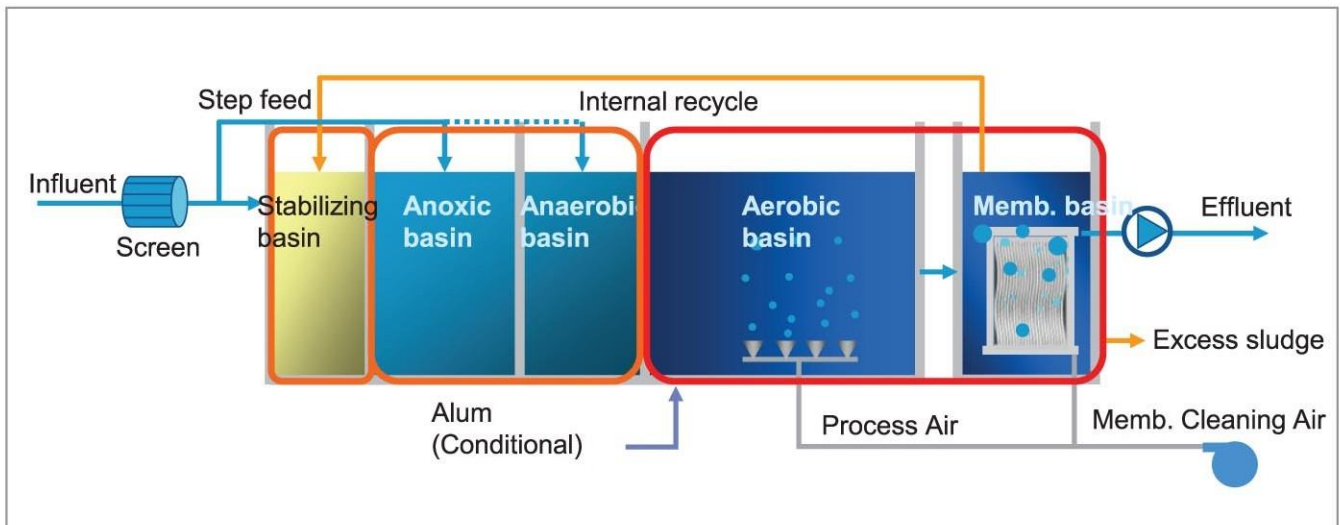
KIMAS Process

(Kolon Immersed Membrane Advanced System)

Subject of Application

Urban sewage, Dirty water, Wastewater, Leachate etc.

Composition of Technique



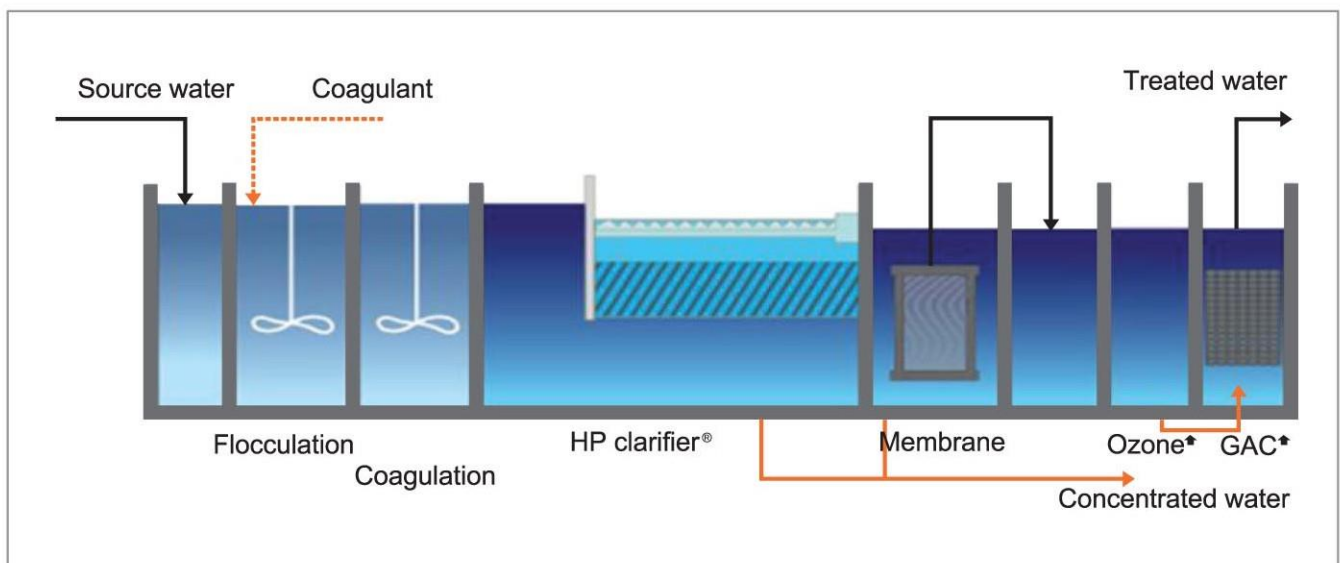
K²IMAS Process

(KOLON/K-Water Immersed Membrane Advanced System)

Applications

Drinking water

Configuration



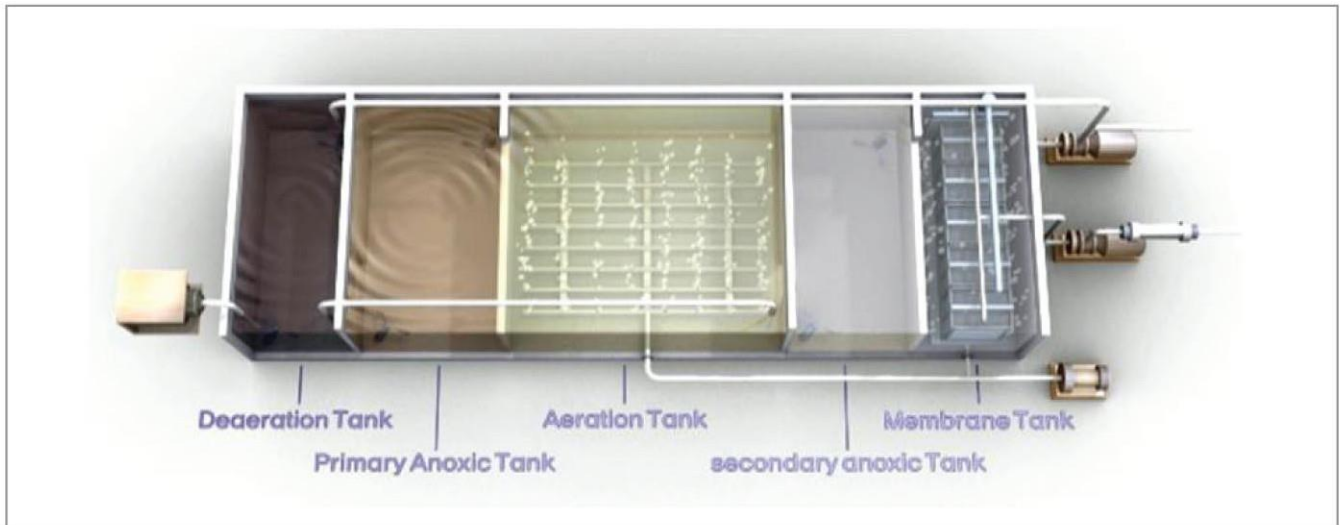
I³ System

(3 Innovation : Process/Product/O&M)

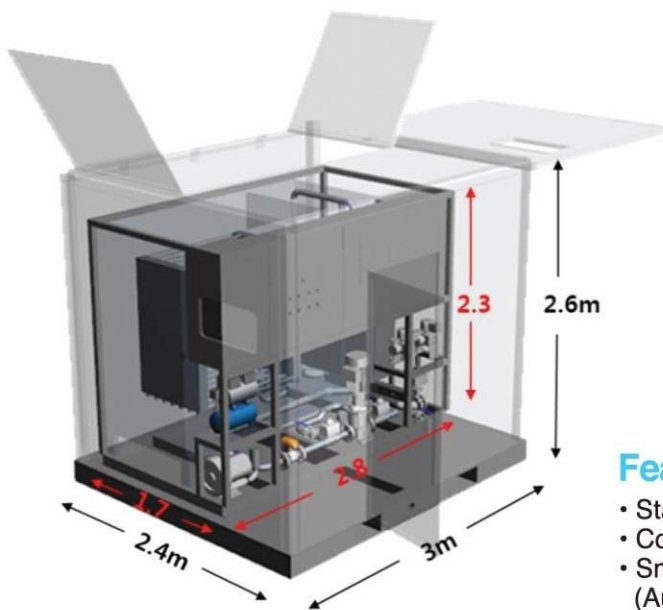
Application

Sewage, Wastewater, Industrial waste water, Leachate etc,

Composition of Technique



KOLON Smart-M Packaged System



	Cleanfil-M60	Cleanfil-M120	Cleanfil-M240
Capacity	60m ² /day	120m ² /day	240m ² /day
Dimension (H×W×D, m)	2.0×2.2×1.5	2.0×2.5×1.5	2.6×3.0×2.4
Process	(Clarification) - MF or UF - Disinfection		
Recovery	~98%		
Application	Ground water, River water		

Features

- Standalone facility
- Compact membrane package system
- Smart operation technology (Automatic control, Diagnostic program, Remote operation)



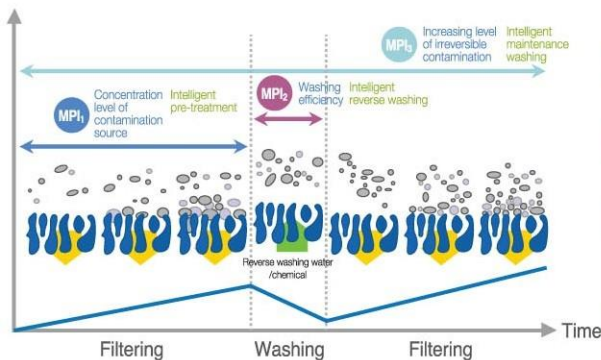
TECH VISION INC.



KOLON GLOBAL CORP.

Integrated operation environment is realized through intelligent automation system and remote control by combining the membrane process technology which is the up-to-date technology in the field of water treatment and IT technology, and the information system building service which supports various tasks is provided by converting the data generated during the operation into the information.

Based on the MPI (Membrane Performance Index) which is developed for the decision making during the process operation with the process control system in which the membrane process technology which is the up-to-date technology in the field of water treatment and IT technology are fused into one, intelligent control is conducted, and the process obstacles due to operation error and change of water quality are minimized with standardization and scientific transformation of operation process, and the convenience of user is maximized by a variety of functions of software with the basis of touch screen and mobile device.



- MPI₁** The contamination level generated during the filtering
Cak/Gel, related with the contamination of concentration polarization layer
- MPI₂** Efficiency of reverse washing
Unremoved contamination, irreversible contamination
- MPI₃** Progressing level of accumulated contamination
Total amount of contamination, reversible / irreversible contamination
- Ce** The recovery level by washing
The recovery level up to the initial membrane performance

MPI#1

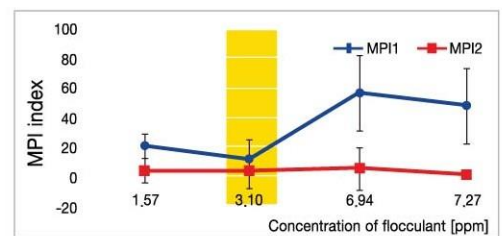
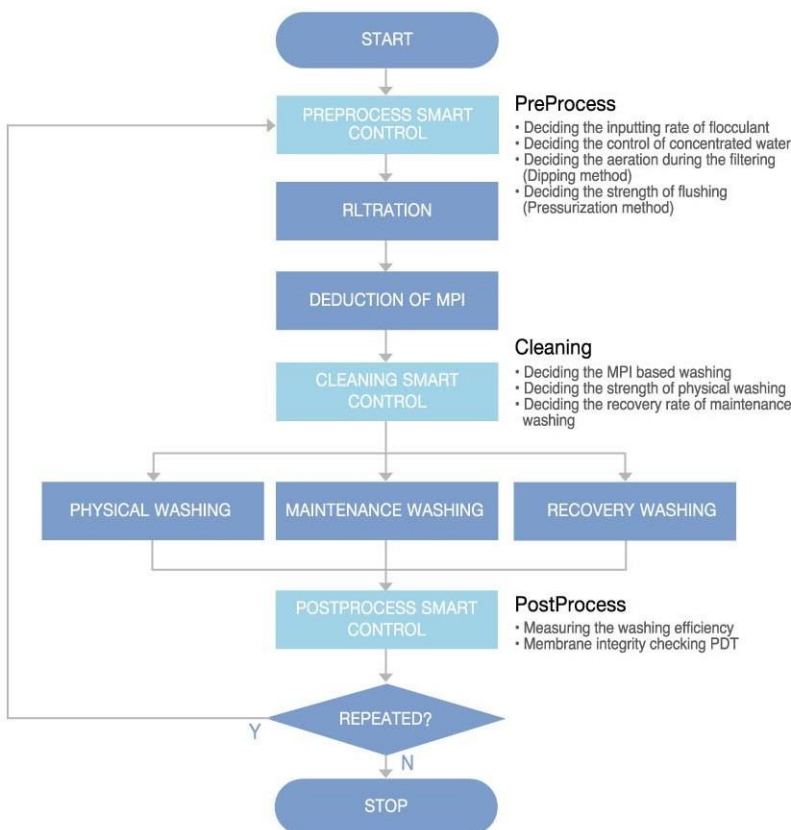
The state of the raw water for measurement can be confirmed with the performance deterioration of membrane which is generated during the filtering, and with the basis of this, the control of flocculant, recovery rate, and so forth can be conducted.

MPI#2

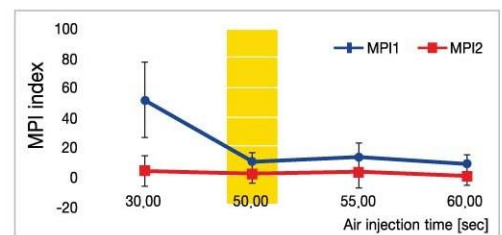
The performance deterioration of membrane by irreversible contamination is estimated by measuring the washing efficiency which is recovered by the reverse washing.

MPI#3

The timings of maintenance washing and chemical washing are estimated by measuring the continuous trend of reversible/ irreversible contamination.

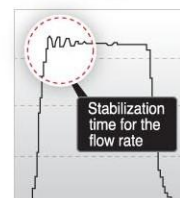


Injecting concentration of flocculant

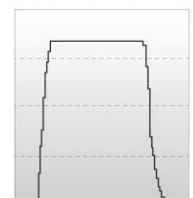


Injecting amount of washing air

General PID control
Requiring more than 1 minute for the fixed



Learning type PID control
Requiring less than 20 seconds for the fixe flow rate control





Based on the HMI software which offers the functions with the capability of monitoring, controlling, analyzing and reporting the diverse equipment data of various industrial sites including the field of water treatment, customized environment and optimized system are provided to the developer and user.

Real time monitoring and controlling HMI software

- Providing the optimum data monitoring, controlling , analyzing and reporting
- Control software for industry which provides real time opened interface and multi project function



HMI web software utilizing network

- Capable of real time monitoring control only with the connection to web browser form client PC
- The HMI web software providing the work environment which is identical with that of the web server under operation



- 64Tag
- 128Tag
- 256Tag
- 512Tag
- 1024Tag
- UnlimitedTag

BENIT HMI 3.0

BENIT HMI Web 3.0

- 512Tag
- UnlimitedTag



Control software and solution for industry

BENIT FMS

BENIT BEMS/FEMS

Facilities management solution

- The facilities management solution with which the information related with facilities can easily be confirmed by facilities operators and administrators, and effective maintenance and management can be conducted, an rapid response can be implemented to unexpected situation



Energy management solution

- The energy saving software with which substantial energy reduction effect can be accomplished by not only monitoring, estimating and analyzing the energy but also directly controlling the required system with the monitoring and estimating data

