

Introduction to PHILOS MF membrane module



Megaflux-MBR

Highly efficient submersible membrane



1. MBR Process

- **Membrane Bio-reactor(Biological treatment + membrane filtration)**
- **Without installing aeration tank, filtrate is produced by suction filtration through submergible membrane in aerobic tank**
- **Hybrid process which fused benefits of biological treatment process and physical filtration process**
- **Outstanding SS, organic matters, nitrogen and phosphorous removal**

MBR Process

MBR Process Features

Filtrate production through membrane filtration

- Suspended solid 100% removal
- Clean filtrate production regardless of settleable sludge
- No risk of MLSS loss due to bulking
- Stable water quality and easy maintenance

Compact process possible

- Neglect of highly concentrated MLSS of 8,000~12,000ppm
- Bioreactor capacity decrease and remaining time decrease due to highly concentrated MLSS
- Construction footprint decrease since no submerged tank is needed

Treated water reuse possible

- Reuse possible with combination with other processes according to application of water
- Grey water can be used for MBR process water
- Can be reused for UF, RO and active carbon according to purpose after post treatment

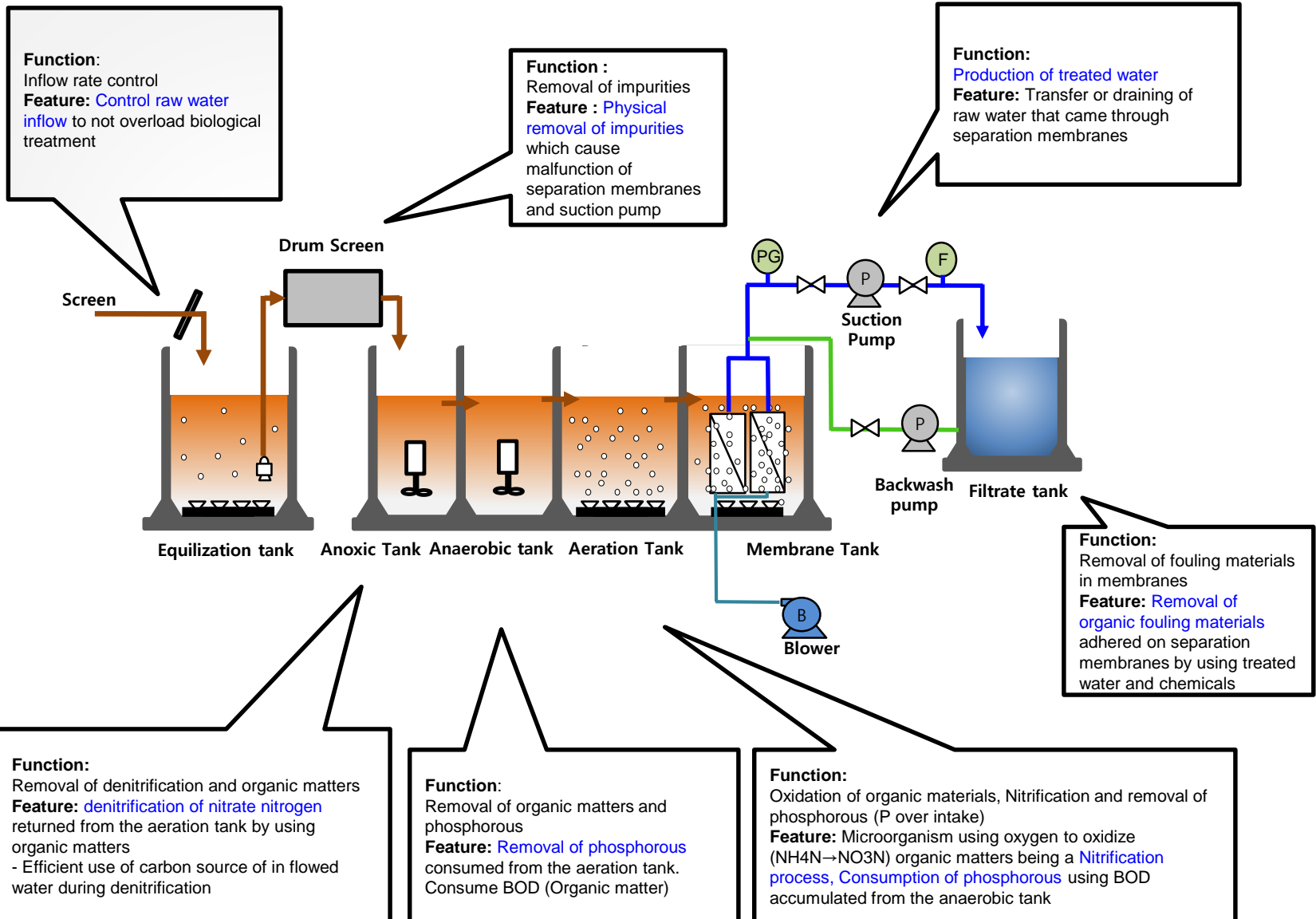
Construction cost reduction

- Construction footprint decrease leading to cost reduction since no submergible tank is required
- Construction footprint decrease due to effectivity increase by highly concentrated MLSS maintenance
- Redundant sludge decrease leading to reduction of sludge treatment cost

MBR
Process

MBR Process

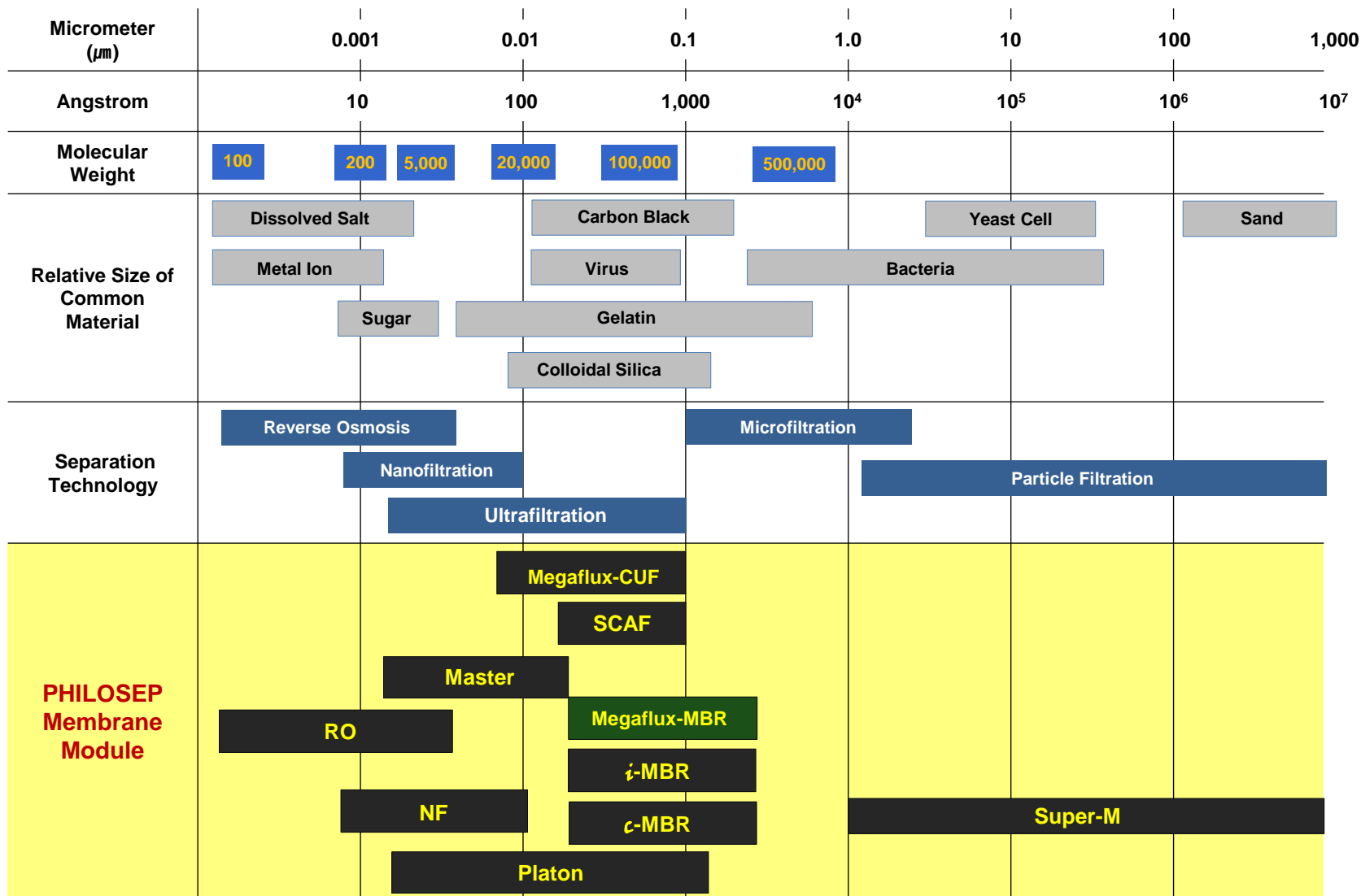
MBR Process Flow





2. PHILOS MF Membrane

Filtration Spectrum

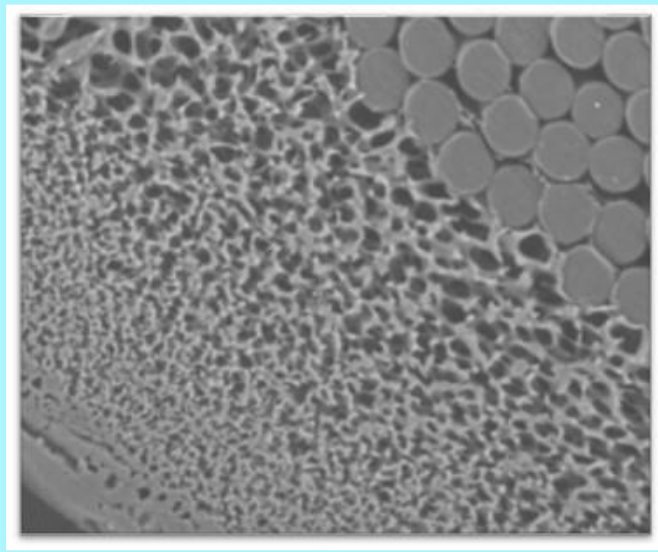


1. **Chemically resistant material and structure** for wastewater treatment
 - Membrane structure and material with **high performance recovery**
 - **Fouling resistant** membrane material and module structure
2. **Stability from mechanical quality**
 - **Prevention of mechanical damage on membrane during aeration**
 - **Leak prevention of adhesion part**
 - **Breakage and tangle prevention**
 - **No peeling of membrane from support**
 - **Prevention of mechanical performance deterioration** of material due to biodegradation and chemical reaction
3. **Operation technique** requirements
 - Solution to **detect damage** during operation
 - **Repair technique** when membrane is damaged
 - **Aerator structure and installation method to minimize membrane fouling**

PHILOS MF Membrane

PHILOS RCM MF

RCM(Reinforced Capillary Membrane) – double membrane consecutive coated reinforced membranes (patented technology)



Properties	Specifications
Membrane Material	Hydrophilic PVDF
Support Material	Polyester
Inner/outer Diameter	1.0 / 2.3 mm
Pore Size	0.1 ~ 5µm
Designed Water Flux (Wastewater / Water treatment)	10 ~ 30 LMH(L/m ² .hr)
Tensile Strength	40 ~ 50 kgf/fiber

- Highly durable **braid is used as membrane support** and displays high durability
- **Chemically resistant** hydrophilic PVDF is **coated on Braid** to **avoid turbidity leakage**
- **Optimal sponge like membrane structure** allows small compaction, and **restoration quality** allows **high flux**
- **No deterioration** after frequent chemical cleaning and displays **high performance** for a long term
- Not only for sewage, wastewater use MBR submersible MF but also high capacity water

1. Membrane which PVDF is impregnated and coated with hydrophilic PVDF on braid (Capillary fiber)

- No breakage of membrane during standard operation (High mechanical strength)
- Operation at low pressure for long term is possible and long lifetime allows minimization of membrane deterioration
- No leakage of turbidity even when membrane surface is peeled off due to PVDF being impregnated into fiber

2. Membrane produced using hydrophilic PVDF with optimal sponge structure

- Less compaction during suction filtration and high performance recovery of material during pause allows maintenance of flux
- Membrane fouling is minimized with low compaction and stable flux is maintained
- Chemically resistant PVDF material is used to allow performance maintenance after frequent chemical washing and long term operation

3. Phase transition method is applied to allow high permeability and even pore size of membrane

- Outstanding suspended solid filtration possible with even pore size formed using phase transition method
- Maintenance of high permeability with even pore size
- Outstanding removal of SS, microorganism and colon bacterium

PHILOS MF Membrane

PHILOS RCM MF Features

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TEST REPORT (등본)

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시험결과

시험항목	단위	시료구분	결과치	시험방법
최대인장하중	N	-	512	의뢰자제시방법(*)

(*) 만능재료시험기(INSTRON 5565), 시험속도: 50 mm/min, 물림거리: 50 mm

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**PHILOS
RCM**

Conventional
reinforced
membrane

Conventional
PE mono
layered
membrane

Ø 0.5mm
fishing line

**512N/fiber
(51.2kgf/fiber)**

250N/fiber
(25kgf/fiber)

17N/fiber
(1.7kgf/fiber)

150N/fiber
(15kgf/fiber)

※ 1N = approximately 0.1 kgf

* No breakage of membranes during standard operation with tensile strength higher than fishing line

3. Megaflux-MBR



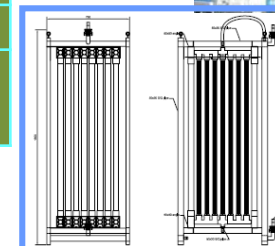
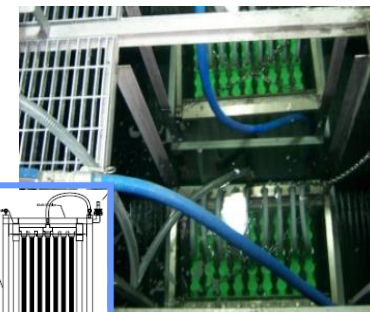
Megaflux-MBR

Megaflux-MBR submersible module for MBR process

MBR Membrane Module for large capacity water treatment

- Element : Integrated aerator RCM membrane
- Frame : Block type for convenient expansion and assembly
- Purpose: Discharge after sewage treatment by MBR or RO pretreatment for water reuse

		Element size (\varnothing x mm)	# of element (ea)	Capacity (m ³ /d)	Module Dimension (WxLxH, mm)
Module	Megaflux-50	46x1290	98	50	719x1068x1780
	Megaflux-60	46x1290	126	60	719x1254x1780
	Megaflux-100	46x1810	200	100	719x1378x2380
	Megaflux-200	46x1810	400	200	1092x1950x380
	Megaflux-300	46x1810	600	300	1344x2190x2380
Operating Condition	Max. Trans-membrane Pressure	< 400 mmHg			
	Normal Pressure	50 ~ 200 mmHg(normal)			
	Max. temp.	40 °C			
	pH range	2 ~ 12			
	Filtration Cycle	5 ~ 7 min. on, 1 ~ 5 min. off (10~14min. On, 0.5~1min Backwash)			
	Chemical Cleaning	In-line Cleaning : NaOCl 300 ~ 500 ppm, twice a day Recovery Clean : NaOCl 3000 ppm, once 2~6 month			



- **Length selection / production according to site condition**

- R4 – applicable to small size MBR site (less than 100 m³/d)
- R3 – applicable to small – mid size MBR site (less than 500 m³/d)
- R2 – applicable to large size MBR sites (more than 500 m³/d)

- **Diverse element organization according to customers' need**

- Module production using elements of different sizes
- Various forms of modules according to customers' requests and site conditions

- **Expandability according to treatment capacity**

- Frame production by installing modules of various sizes
- Various forms of frames according to customers' requests and site conditions

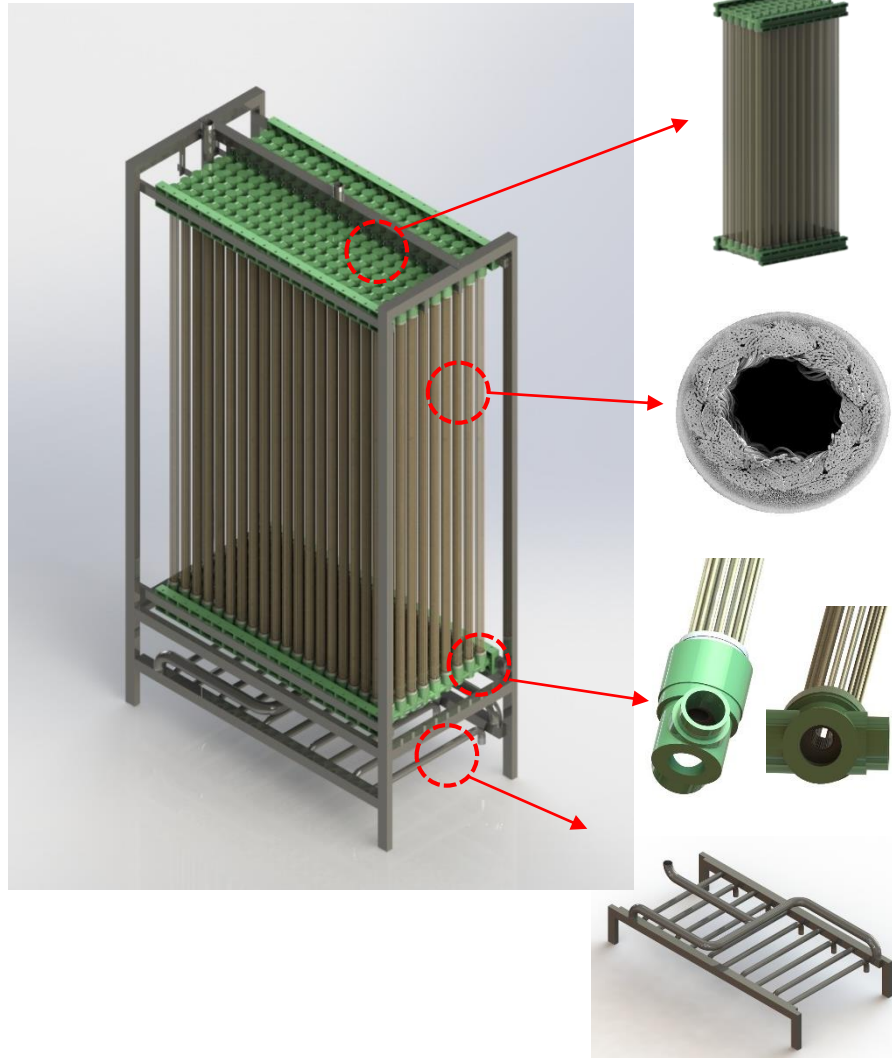
- **Custom made production**

- Custom made production possible without guide modification or construction when replacing submersible membranes



Megaflux-MBR

Megaflux-MBR Features



Convenient customization according to sites and simple assembly and disassembly with block structure

Customized production where no guide installation is required during replacement

Application of fluororesin braid reinforced membrane

High mechanical strength and maintains outstanding water quality since no breakage of membrane occurs during operation

Membrane with Optimal sponge structure of hydrophilic material applied

High performance recovery allow stable flux

Element structure for effective aeration

Element structure with separate diffuser for minimization of membrane fouling during operation

Sludge discharging diffuser structure

Blockage problem solved by open type diffuser for sludge discharge

1. Newly established wastewater and sewage treatment facility

- Footprint reduction since no facility such as submerged sterilization is necessary and grey water treatment is possible without additional equipment

2. Existing wastewater treatment modification

- Treatment possible without separate civil construction by submerging membrane separation device in existing aeration tank

3. Grey water treatment

- MBR can be simply used for grey water and by combination with ozone and activated carbon treatment, can be utilized as sprinkling water, irrigation and cleaning water

4. Wastewater treatment process

- For highly concentrated wastewater treatment, food, animal husbandry and organic wastewater treatment



3. **Megaflux-MBR** Operation and experience

Megaflux-MBR Operation

Membrane process operation

- Permeability is a crucial factor when determining membrane performance
- Do not operate at higher operation pressure than 450mmHg (0.6bar) for more than 4 hours
- Backwash pressure should not exceed 0.7bar



Membrane operation process variables

- Instantaneous flux
- Transmembrane pressure
- MLSS concentration
- Membrane washing method and frequency

Factors that influence membrane permeability

- Low temperature
- Lack of aeration
- Sludge filtration performance deterioration
- Fouling by sludge
- Membrane fouling



Recovery washing

- Membrane washing method by adding concentrated washing chemical directly into membrane tank (chemical washing tank) filled with tap water / treated water
- More washing chemical is required compared to backwash and submerged washing
- Generally >3,000 ppm NaOCl and 2,000 ppm citric acid is required
- Membrane washing method by backwashing washing chemical of higher concentration through membrane lumen while membrane tank is empty
- Process tank would be filled with tap water / treated water when backwash is complete. Keep submerged in washing chemical.
- Control submerge duration according to membrane fouling and recovery level (Within 4 ~ 12 hours)

Backwash maintenance washing

- More washing chemical is required for backwash maintenance (submerged) washing than recovery (submerged) washing
- Generally 500 ppm NaOCl and 1,000 ppm citric acid is required

- Chemical type according to foulant

Foulant	Chemical	Remarks
Organic matter	NaOCl	< 3,000ppm
Silica, organic matter	NaOH	< 4%
Colloid, inorganic matter	HNO ₃ , HCl	< 2%
	Oxalic acid	< 2%

- Back wash : NaOCl <500ppm (Maintenance washing)
- pH Range: 4.0~11.0 at standard operating condition, 2.0~13.0 at chemical washing

Megaflux-MBR Experience

No.	Installation site	Capacity	Purpose
1	Incheon Cheonglado landfill	1,350m ³ /day	Leachate treatment
2	Chungbuk Eumseong S golf club	200m ³ /day	Wastewater treatment
3	A thermoelectric power plant seawater RO pretreatment	300m ³ /day	RO pretreatment
4	Icheon H company	4000m ³ /day	Organic wastewater treatment
5	Seould Yeouido A construction company office	120m ³ /day	Grey water treatment
6	Busan A construction company B condominium	100m ³ /day	Wastewater treatment
7	Jeju Aiweol T golf club	400m ³ /day	Wastewater treatment
8	Gyeonggido Ansung animal husbandry town	200m ³ /day	Wastewater treatment
9	Gyeonggido Pochun A company	100m ³ /day	Wastewater treatment
10	Gyeonggido Yongin mission work center	170m ³ /day	Wastewater treatment
11	Incheon Youngheung federation of fisheries	100m ³ /day	Wastewater treatment
12	S nuclear plant 3 & 4	150m ³ /day	Wastewater treatment
13	Cheonan M golf club	Product Site Capacity	Megaflux 540 33,828m³/day
14	Gongju P golf club		
15	Seoul A company pilot test		
16	Incheon airport subway Keyang station wastewater treatment		

Megaflux-MBR Experience

■ Icheon H company organic wastewater treatment using Megaflux-MBR

Application	Installation site	Treatment capacity (m ³ /d)	No. of modules applied (ea.)
Organic wastewater treatment	Icheon	4,000	Megaflux-42 (96 Frames)

■ Process Design

- Process: Raw water - drum screen- Megaflux-MBR
- Operating Logic : 6 min. suction – 2 min. pause
- Operation pressure : 200mmHg
- Water quality : SS less than 5 ppm



Megaflux-MBR Experience

■ Incheon Cheonglado landfill leachate treatment using Megaflux-MBR

Application	Installation site	Treatment capacity (m ³ /d)	No. of modules applied (ea.)
Landfill leachate treatment	Incheon Chenglado	1,350	Megaflux-50 (32 Frames)

■ Process Design

- Process: Raw water - drum screen- Megaflux-MBR
- Operating Logic : 7 min. suction – 3 min. pause
- Operation pressure : 200mmHg
- Water quality: SS less than 5 ppm

