3E MEMTECH PTE. LTD

Official Website **Download This Brochure**

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About us

High-Tech Enterprise

3E Memtech Pte. Ltd specializes in R&D and production of membrane technology, offering high-quality products and services for material separation and water treatment. In partnership with NUS, 3E focuses on industrial-scale commercialization. Our 2019 3E-NF Nanofiltration (NF) membrane is the world's first with anti-fouling, oxidation, acid, and alkali resistance properties.

The World's First

The 3ENF series NF membrane is the world's first :

- ✓ Full molecular weight seperation
- ✓ High oxidation resistance
- ✓ Fouling resistance
- ✓ acid-alkali resistant

Hollow Fiber (HF) NF membrane

01 3E ADVANCED HF NF MEMBRANE

3ENF HF NF Membrane with Full Molecular Weight Separation and Oxidation Resistance

The current market-available NF membranes are primarily of two types. Polyamide membranes degrade with chlorine exposure, while cellulose acetate membranes are susceptible to hydrolysis, poor acid/alkali resistance. Both require extensive pretreatment, increasing operational costs..

Additionally, both flat sheet NF and RO membrane modules are spiral-wound structures, which presents drawbacks:

- ➢ unsuitable for typical cleaning methods like backwash, forward flushing, and air scouring;
- ➢ Mesh-woven spacers in water channels create dead zones, causing rapid fouling, cleaning challenges, and increased operational costs.

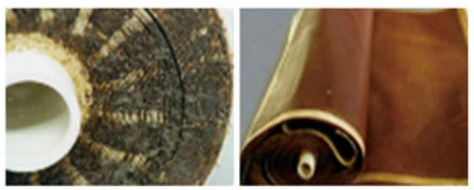
Solutions

Interface micro-mixing technology enables one-step production of versatile HF NF membranes with chlorine resistance and anti-fouling properties.

One-step spinning, and online interfacial cross-linking

The membrane material is antibacterial and resistant to oxidation, such as free chlorine

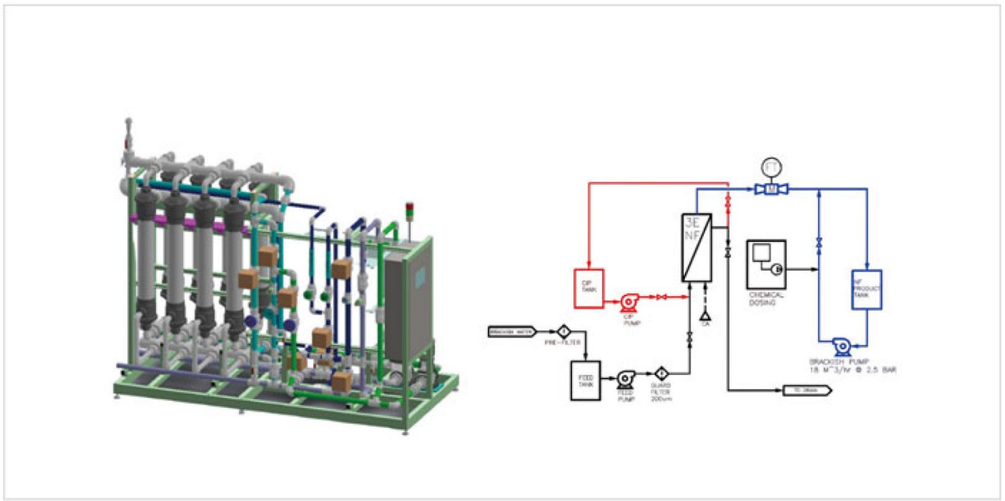
The smooth, thick selective layer enhancing its resistance to fouling and scratching.



Fouling mechanism of spiral NF and Reverse Osmosis(RO) membranes

Diagram of 3ENF HF Module Water Treatment System

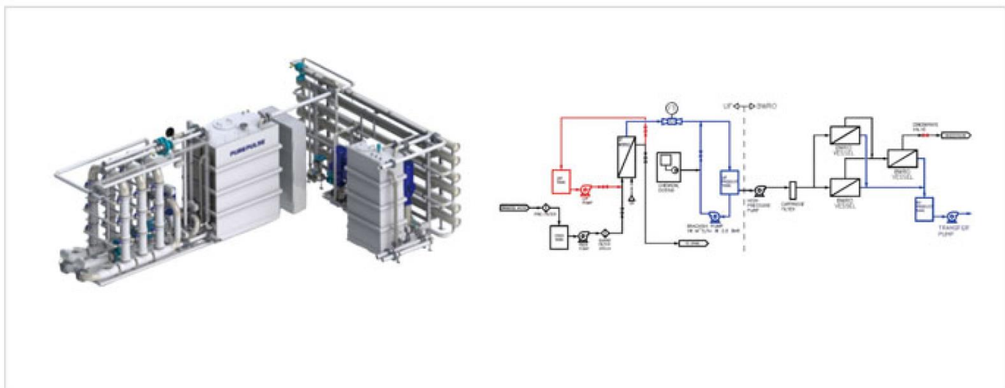
Oxidation chemical such as sodium hypochlorite can be used to reduce microbial contamination, due to 3E-NF membranes' resistance to acids, alkalis, and free chlorine. 3E-NF HF module can be operated under the same conditions as UF membranes, with no strict requirement of feed water, reducing costs.



3E-NF60 Laundry Wastewater Circulation System

Diagram of Conventional Spiral-wound NF or BWRO Systems

Spiral-wound NF membranes and BWRO membranes have strict requirements for feed water quality. The UF pretreatment system must be used to meet its feed water quality requirements, such as turbidity less than 1.0 NTU.



Laundry Wastewater UF-RO Circulation System

Engineering Application Value

3ENF HF membrane can simplify process equipment and reduce footprint in engineering applications, greatly reducing the costs.

- Anti-fouling:

With smooth flow channel, no strict requirements of feed water, and free of pretreatment with UF membrane

- Chemical resistance:

Oxidation chemical can be used to reduce fouling, maintaining stable flux and extend membrane life

- Dense and smooth surface:

Surface will not be easy to be damaged by slight scratches, and can work normally in harsh environments

Parameters

Material	Polyvinylidene fluoride/polyethersulfone Composites
ID/OD（mm)	0.45/0.85;0.5/0.98
Salt rejection rate，% 2000 ppm $MgSO_4$	01,05,10,20,40,60,80,90
Water flux，LMH/bar	20-200, related to salt rejection
Operating pressure	1.0-8.5 bar
Temperature range**	**5-80℃**
pH	2.0-12.0 (cleaning 1.0-12.0)
Tensile strength of the membrane	2.5-4.5 Mpa
Module size	1-10", customizable
Operation Mode	Outside-in

The Unique Advantages of 3ENF Membranes

NF membranes have larger pore size than RO membranes, thus the osmotic pressure is smaller than that of RO membranes, which reduces filtration resistance, so they have the following unique advantages that RO membranes lack:

- High recovery rate and less concentrated wastewater
- Low operating pressure reduces energy consumption in water treatment system
- No UF membrane pre-filtration, less equipment footprint and investment

Lower Investment in Fixed Assets

The equipment is cheap and occupies less space

Lower Operation Costs

System operation pressure is low, not easy to damage and less repair

Higher Water Recovery

Special structure of selective layer, low osmotic pressure and high recovery

	Special Advantages	Related Causes (Primary)	3ENF	Conventional UF/RO	Other NF
1	Available low-pressure backwash	Uncoated HF membrane structure	√	×	√
2	Anti-biofouling*	Smooth and dense surface, less algae adhesion	√	×	×
3	Resistant to oxidation and acid-base corrosion	Special material of selective- layer	√	×	×
4	Anti-fouling and scaling*	Super hydrophilic, smooth and dense selective-layer	√	×	×
Note	√ Smoother surfaces are less prone to fouling √ Improved hydrophilicity of the membrane surface provides better resistance to fouling √ A lot of dirt is hydrophobic in nature				

3E HF NF Membrane Series

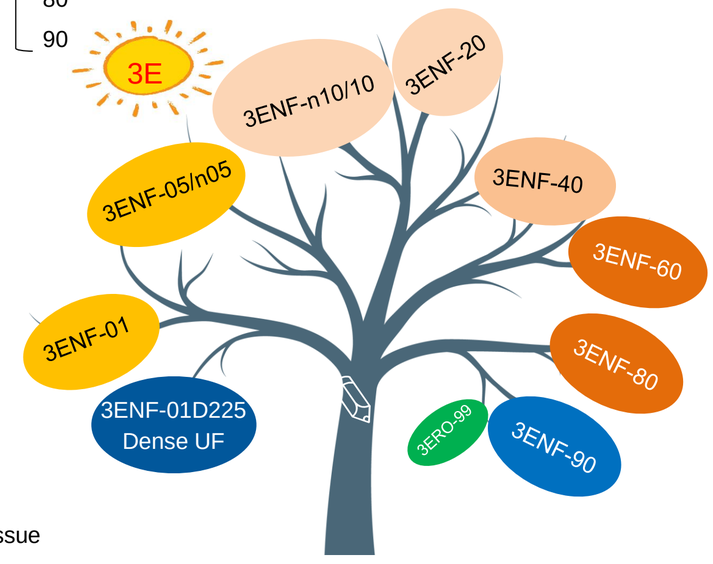
NF Series:

3ENF-X XX X 16 12

- L: 12(1.2)/16(1.6)/20(2.0m)
- OD: 16(160)/20(200)/22(225mm)
- n: Modified Products
- Application Field
  - m – municipal & Industrial
  - s – material separation
- Module No.
  - 01
  - 05
  - 10
  - 20
  - 40
  - 60
  - 80
  - 90

3ENF Product Series	MWCO (Da)
3ENF-01D	8000-10,000
3ENF-n05/05	3,000-8,000
3ENF-n10/10	1,600-2,500
3ENF-20	1,400-1,600
3ENF-40	700-900
3ENF-60	600-750
3ENF-80	500-600
3ENF-90	250-500
3ERO-99 (Not Yet Launch)	<200

More Applications!



Dense UF

- NF-01D225 MWCO 10K Dalton
- Slightly reduce the COD and hardness
- Used for seawater desalination and wastewater recycle

COD & Hardnes

NF01/05/10 used for:

- COD reduction、
- Colloid removal，
- Hardness reduction，
- Reduce the fouling and scaling issue of the RO system

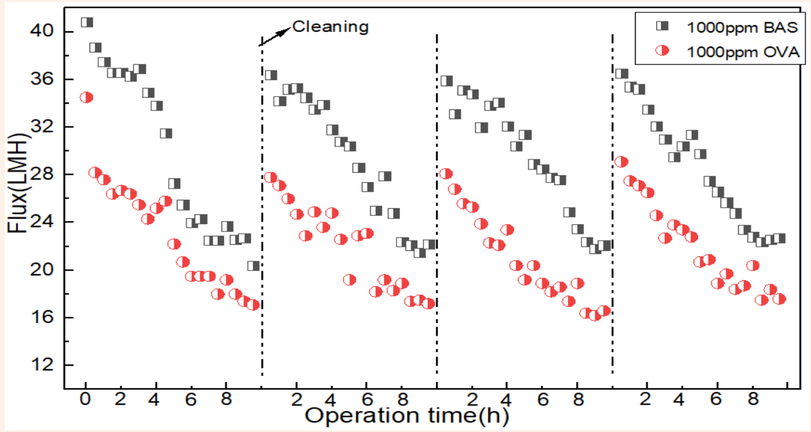
Brackish Water

- Replace the existing UF/RO process for brackish water treatment
- Material separation

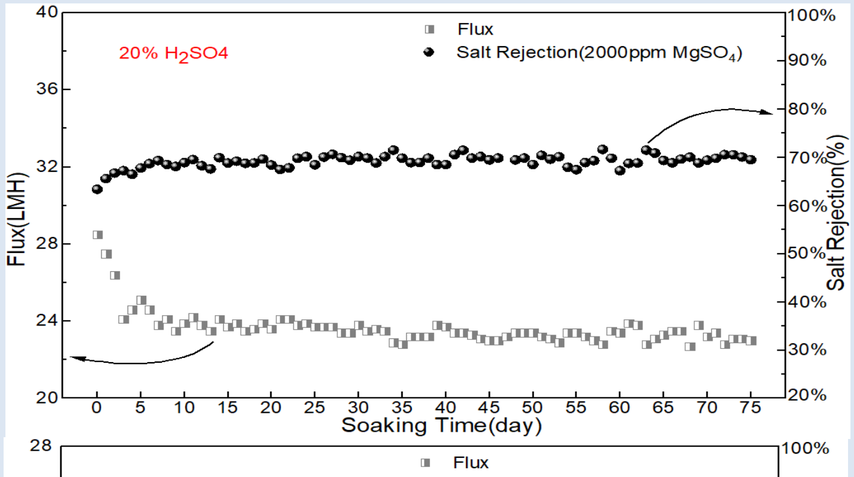
Material Seperation

- A variety of membrane products with molecular weight cut-off can realize the separation and purification of organic matter with different molecular weights.
- It can replace existing high-cost and high-energy consumption processes such as activated carbon adsorption, ion exchange resin adsorption, rolled RO, NF membrane, etc.

3ENF HF Membranes Advantages in Application



❖ **Strong fouling resistance and renewability**



❖ **Strong resistance to acids and alkalis.**

❖ **Membrane performance remains stable in 5%NaOH or 20% H_2SO_4 solution**

Potential Applications of 3ENF HF Membranes

The 3ENF HF membrane system reduces Capex by eliminating the need for UF pretreatment and UV disinfection, cutting costs and shortening the payback period compared to spiral-wound NF/RO systems.

Material Separation

Water Treatment

Application Range of 3E-NF Membranes

Drinking Water

Water Quality Before Filtration	Traditional Process	3ENF Process	Key Benefits of the 3ENF System
Centralized treatment for micro polluted surface water (post coag-sed-sand filt.)	UF+BWRO/NF + remineralization*	3ENF-05/10/20/40/90	Capex reduced by >40%, Opex by 60%
Centralized treatment for brackish water (high hardness, high SO_4)	UF+BWRO/NF + remineralization*	3ENF-90	Capex reduced by >40%, Opex by 50%
High-quality direct drinking water system in the community	UF+BWRO/NF + remineralization*	3ENF-05/10/20/90	Capex reduced by >40%, Opex by 60%
Tap water (household water dispenser)	UF+BWRO/NF+ A/C + remineralization	3ENF-05/10/20/90 +A/C	Longer life and more reliable, high quality drinking water is available
Whole house water purification system	UF (PVDF) or microfiltration (PTFE)	3ENF-01/05/10/ 20/90	Reduce the hardness in the water, removes bacteria and viruses
Remark	A/C: activated carbon, UF: UF membranes, BWRD/NF: low pressure spiral-wound RO or NF membranes.		

Desalination

Water Treatment	Traditional Process	3ENF Process	Key Benefits of the 3ENF System
Desalination Pretreatment*	UF	3ENF-01/05	Removes partial hardness, bacteria, viruses, algae; less RO fouling; reduces maint. cost, increase H2O production capacity.
Desalination*	UF+SWRO	3ENF-01/05+SWRO	
Remark	Smooth and dense surface, less algae adhesion Reduce feed water salinity of RO system, and improve system water recovery rate , reducing the cost		

Industrial Wastewater Reuse

Wastewater Treatment	Traditional Process	3ENF Process	Key Benefits of the 3ENF System
Cooling tower drainage and dyeing wastewater reuse	UF+BWRO/(FS-NF)	3ENF-90	Removes heavy metals, bacteria, viruses; controls algae, heavy metals; reduces wastewater discharge & Opex
Fluoride haz. wastewater treatment & recycling for electronics	NA	3ENF-90+RO	RO water recycled as process water, low conc. HF as industrial feedstock
Wastewater recycling for marine aquaculture & high-salt food ind.	UF+BWRO/(FS-NF)	3ENF-05/10/20/40/60/80	Recycle clean brine, reducing sodium chloride consumption and wastewater discharge costs
Mining and oil extraction wastewater backfill	UF+BWRO/(FS-NF)	3ENF-60/90	Reduce the cost of wastewater treatment and backfilling in mines and oilfields
Material separation and extraction of high-value plant elements	UF+BWRO/(FS-NF)	3ENF 01/05/10/20/40/60 /80/90	Simplify material separation process, less chemical additives and wastewater discharge
Treatment and discharge of ballast water in the oversea-shipping industry	UF+BWRO/(FS-NF)	3ENF-90	Remove heavy metals and all bacteria and viruses, reducing the marine pollution caused by discharge
Remark	High-salinity wastewater: veg. pickling, marine aquaculture effluent, etc.		

Municipal Sewage Treatment

Wastewater Treatment	Traditional Process	3ENF Process	Key Benefits of the 3ENF System
Municipal wastewater reuse for landscaping or cleaning purposes*	UF+BWRO	3ENF-05/10/20/90	Reduce Capex and Opex for wastewater reuse
Drinking water from municipal sewage recycle	UF+BWRO+ mineralization	3ENF-90A**	High reliability and water recovery, low maintenance costs
Remark	* The reclaimed water can be used for industrial water, such as cooling towers, boiler, chiller, irrigation, etc. **Treated water can be used for bottled water		

01 3ENF-01 NF MEMBRANE

Introduction

The 3ENF-01 high-flux membrane series (molecular weight cut-off range 8.0k-10.0 KDa, dense UF) offers high water flux and impurity removal rate. Suitable for municipal and industrial wastewater pretreatment, it removes viruses, bacteria, algae, and reduces hardness, mitigating fouling of subsequent reverse osmosis membrane. With low energy consumption and maintenance costs, 3ENF-01 greatly lowers expenses of municipal and industrial wastewater treatment.

It has been used for:

- Water recycle projects, replacing UF membranes for RO pretreatment, reducing maintenance cost
- In direct drinking water projects, substituting double-membrane process, greatly lowering cost

Typical Applications

- Material seperation
- High-quality bottled water production
- Whole-house water purification
- Wastewater recycle
- Seawater desalination pre-filtration, etc.

Parameters

Mat'l	Module No. (size, mm)	Eff. Mem. Area: m^2	Permeate Flow Rate m^3/day	Salt rejection(%) 2000ppm $MgSO_4$	Max Free-chloride resistance; ppm	Max Opt. pressure / (Max pH range)
PVDF	3ENF-01m2012 (Ø200×1200)	34.0±0.5	66.0±5.0	0.5 - 1.0	2000	2.0 bar/(2-12)
	3ENF-01m2020 (Ø200×2000)	60.0±0.5	117.0±10.0	0.5 - 1.0	2000	2.0 bar/(2-12)
	3ENF-01m2220 (Ø225×2000)	75.0±0.5	146.0±10.0	0.5 – 1.0	2000	2.0 bar/(2-12)
Test Conditions	1. Water temperature 25℃; pH 7.5-8.0, test pressure 1.0 bar; 2. Outside-in membrane module, operating temperature 5-40 ℃, Max. backwash pressure is 2.5 bar 3. Maximum Trans-Membrane Pressure (TMP) is 2.0 bar 4. Fiber ID/OD: 0.45/0.85 mm (Comes with membrane shell of high-temperature resistance, which can operate at high temperature)					

Note: For engineering design parameters and information, please consult with our technical staff and obtain the latest version of the technical manual

02 3ENF-05 NF MEMBRANE

Introduction

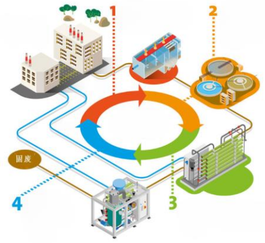
With high water flux and impurity removal rate, 3ENF-05 high-flux membrane achieves high performance in desalination pretreatment, removing viruses, bacteria, reducing hardness, mitigating fouling of subsequent RO membrane. It has low energy consumption, greatly reducing desalination cost, and is suitable for high-quality household water production.

It has been used for:

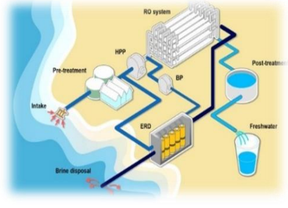
- Water reuse projects, replacing UF membranes for RO pretreatment, reducing maintenance cost
- Direct drinking water projects, substituting double-membrane process, greatly lowering cost

Typical Applications

- Material separation
- Zero discharge of wastewater
- Household drinking water terminal purification
- Whole-house water purification
- Seawater desalination pre-filtration, etc.



Zero Discharge of Wastewater



Desalination

Parameters

Mat'l	Module No. (size, mm)	Eff. Mem. Area: m^2	Permeate Flow Rate m^3/day	Salt rejection(%) 2000ppm $MgSO_4$	Max Free-chloride resistance; ppm	Max Opt. pressure / (Max pH range)
PES	3ENF-05m2012 (Ø200×1200)	35.0±0.5	122.5±2.0	3.5±1.0	1000	8.5 bar/(2-12)
	3ENF-05m2020 (Ø200×2000)	63.0±0.5	217.7±5.0	3.5±1.0	1000	8.5 bar/(2-12)
Test Conditions	1. Water temperature 25℃; pH 7.5-8.0, test pressure 4.8 bar; 2. Outside-in membrane module, operating temperature 5-40 ℃, Max. operating pressure is 8.5 bar; 3. Maximum osmotic flush (backwash) pressure:0.5-0.8 bar; 4. ID/OD: 0.50/0.98 mm (Comes with membrane shell of high-temperature resistance, which can operate at high temperature)					

Note: For engineering design parameters and information, please consult with our technical staff and obtain the latest version of the technical manual

03 3ENF-n05 NF MEMBRANE

Introduction

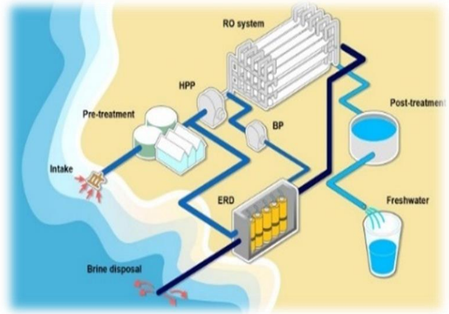
3ENF-n05 (MWCO in the range of 2500-3500Da) high-flux nanofiltration membrane is a modified product of 3ENF-05 (MWCO in the range of 3500-4000Da), which has a denser membrane surface and its screening effect is better than 3ENF-05. In the pretreatment of municipal, industrial water (including wastewater) and seawater desalination, if there are higher requirements for the quality of the produced water (lower hardness and less scaling tendency of subsequent RO), without sacrificing water flux, 3ENF-n05 can be used as a substitute for 3ENF-05 to meet user needs.

3ENF-n05 high-flux nanofiltration membrane has been used in the following fields:

- Used for material separation and extraction of natural additives, such as the separation and purification of bile acids in biotech projects.
- In direct drinking water projects, the double-membrane method has been replaced in some areas with better water quality, greatly reducing the cost of direct drinking water;

Typical Applications

- Material separation
- Zero liquid discahrge
- Household drinking water terminal purification
- Whole house water purification
- Feed water pretreatment for seawater desalination, etc.



Parameters

Mat'l	Module No. (size, mm)	Eff. Mem. Area: m²	Permeate Flow Rate m³/day	Salt rejection(%) 2000ppm $MgSO_4$	Max Free-chloride resistance; ppm	Max Opt. pressure / (Max pH range)
PES	3ENF-n05m2012 (Ø200×1200)	35.0±0.5	96.6±2.0	5.0±1.0	1000	8.5 bar/(2-12)
	3ENF-n05m2020 (Ø200×2000)	63.0±0.5	171.5±5.0	5.0±1.0	1000	8.5 bar/(2-12)
Test Conditions	1. Water temperature 25℃; pH 7.5-8.0, test pressure 4.8 bar; 2. Outside-in membrane module, operating temperature 5-40 ℃, Max. operating 8.5 bar; 3. Maximum osmotic flush (backwash) pressure:0.5-0.8 bar; 4. ID/OD: 0.50/0.98 mm (Comes with membrane shell of high-temperature resistance, which can operate at high temperature)					

Note: For engineering design parameters and information, please consult with our technical staff and obtain the latest version of the technical manual

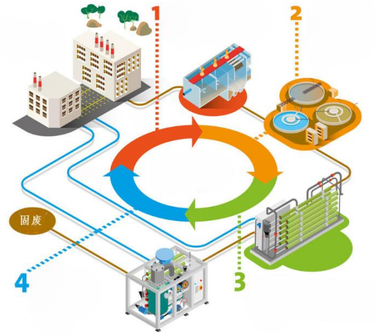
04 3ENF-10 NF MEMBRANE

Introduction

3ENF-10 series is nanofiltration membrane with high water flux and impurity removal rate, suitable for residential applications.

It can be used for:

- Remove COD from water and reduce organic pollution of reverse osmosis membrane
- Removing hardness to reduce hair and skin irritation during showering;
- Removing viruses and bacteria in tap water treatment and transportation to ensure drinking water health;
- Retaining beneficial body minerals for health;
- Low energy consumption and cost systems, easy for end-users.



Typical Applications

- Zero liquid discharge
- Material separation, plant extraction and purification
- Household water softener (whole-house water purification)
- Feed water pretreatment for seawater desalination, etc.

Parameters

Mat'l	Module No. (size, mm)	Eff. Mem. Area: m²	Permeate Flow Rate m³/day	Salt rejection(%) 2000ppm $MgSO_4$	Max Free-chloride resistance; ppm	Max Opt. pressure / (Max pH range)
PES	3ENF-10m2012 (Ø200×1200)	35.5±0.5	49.6±5.0	18.0±5.0	1000	8.5 bar/(2-12)
	3ENF-10m2020 (Ø200×2000)	63.0±0.5	88.0±8.0	18.0±5.0	1000	8.5 bar/(2-12)
Test Conditions	1. Water temperature 25℃; pH 7.5-8.0, test pressure 4.8 bar; 2. Outside-in membrane module, operating temperature 5-40℃, Max. operating 8.5 bar; 3. Maximum osmotic flush (backwash) pressure:0.5-0.8 bar; 4. ID/OD: 0.50/0.98mm (Comes with membrane shell of high-temperature resistance, which can operate at high temperature)					

Note: For engineering design parameters and information, please consult with our technical staff and obtain the latest version of the technical manual

05 3ENF-n10 NF MEMBRANE

Introduction

As a modified product of 3ENF-10 (MWCO in the range of 1600-2000Da) high-flux nanofiltration membrane, 3ENF-n10 (MWCO in the range of 2000-2500Da) nanofiltration membrane has a looser surface structure and higher yield amount of water. When the product water hardness and COD removal rate are higher than expected and the project cost is high, 3ENF-n10 can be used instead of 3ENF-10 to reduce the number of membrane modules used and reduce the total cost.

3ENF-05 high-flux nanofiltration membrane has been used in the following fields:

- Used in some zero-discharge projects to remove organic pollutants in water and remove some hardness and heavy metal ions;
- Material separation for extracting high-value components in biomedical projects
- In direct drinking water projects, the double membrane method has been replaced in some areas with better water quality, greatly reducing the cost of direct drinking water;

Typical Applications

- Zero liquid discharge
- Material separation, plant extraction and purification
- Household water softener (whole-house water purification)
- Feed water pretreatment for seawater desalination, etc.

Parameters

Mat'l	Module No. (size, mm)	Eff. Mem. Area: m²	Permeate Flow Rate m^3/day	Salt rejection(%) 2000ppm $MgSO_4$	Max Free-chloride resistance; ppm	Max Opt. pressure / (Max pH range)
PES	3ENF-n10m2012 (Ø200×1200)	35.5±0.5	61.9±2.0	10.0±3.0	1000	8.5 bar/(2-12)
	3ENF-n10m2020 (Ø200×2000)	63.0±0.5	110.0±5.0	10.0±3.0	1000	8.5 bar/(2-12)
Test Conditions	1. Water temperature 25℃; pH 7.5-8.0, test pressure 4.8 bar; 2. Outside-in membrane module, operating temperature 5-40℃, Max. operating 8.5 bar; 3. Maximum osmotic flush (backwash) pressure:0.5-0.8 bar; 4. ID/OD: 0.50/0.98mm (Comes with membrane shell of high-temperature resistance, which can operate at high temperature)					

Note: For engineering design parameters and information, please consult with our technical staff and obtain the latest version of the technical manual

06 3ENF-20 NF MEMBRANE

Introduction

3ENF-20 membrane has high water flux, low desalination rate for industrial and residential applications like household water softeners. Excellent separation performance removes bacteria, viruses, antimicrobial compounds, organic pollutants, hardness, heavy metal pollution at low cost.

It has been used for:

- Mariculture wastewater reuse project, replacing double membrane or moving bed biofilm reactor process, lowering system investment and operating costs
- Direct drinking water project, reducing hardness for healthy water

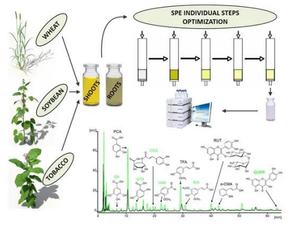
Typical Applications

- Material separation
- Whole house water purification
- High-quality bottled water production
- Household water softener
- Wastewater reuse in seawater aquaculture
- Zero Liquid Discharge, etc.

Parameters

Mat'l	Module No. (size, mm)	Eff. Mem. Area: m²	Permeate Flow Rate m^3/day	Salt rejection(%) 2000ppm $MgSO_4$	Max Free-chloride resistance; ppm	Max Opt. pressure / (Max pH range)
PES	3ENF-20m2012 (Ø200×1200)	35.0±0.5	37.2±3.0	30.0±5.0	1000	8.5 bar/(2-12)
	3ENF-20m2020 (Ø200×2000)	63.0±0.5	66.0±6.0	30.0±5.0	1000	8.5 bar/(2-12)
Test Conditions	1. Water temperature 25℃; pH 7.5-8.0, test pressure 4.8 bar; 2. Outside-in membrane module, operating temperature 5-40 ℃, Max. operating 8.5 bar; 3. Maximum osmotic flush (backwash) pressure:0.5-0.8 bar; 4. ID/OD: 0.50/0.98 mm (Comes with membrane shell of high-temperature resistance, which can operate at high temperature)					

Note: For engineering design parameters and information, please consult with our technical staff and obtain the latest version of the technical manual



07 3ENF-40 NF MEMBRANE

Introduction

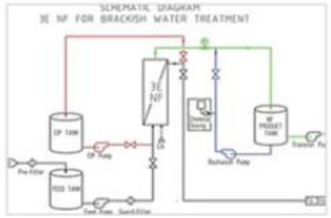
3ENF-40 membrane has high water flux and medium rejection rate, used for: 1) dyeing wastewater treatment, 2) filtering antimicrobial compounds, 3) reducing water hardness (heavy metals), 4) removing bacteria and viruses. Developed for low-cost dyeing wastewater treatment.

It has been successfully used for:

- Mariculture wastewater reuse project, replacing double-membrane or moving bed biofilm reactor process, lowering system investment and operating costs
- Direct drinking water project, reducing hardness for healthy water

Typical Applications

- Material separation
- Food wastewater recycle
- Whole house water purification system
- Dyeing wastewater treatment, etc.



Parameters

Mat'l	Module No. (size, mm)	Eff. Mem. Area: m²	Permeate Flow Rate m³/day	Salt rejection(%) 2000ppm $MgSO_4$	Max Free-chloride resistance; ppm	Max Opt. pressure / (Max pH range)
PES	3ENF-40m2012 (Ø200×1200)	35.0±0.5	26.9±3.0	45.0±5.0	1000	8.5 bar/(2-12)
	3ENF-40m2020 (Ø200×2000)	63.0±0.5	47.7±6.0	45.0±5.0	1000	8.5 bar/(2-12)
Test Conditions	1. Water temperature 25℃; pH 7.5-8.0, test pressure 4.8 bar; 2. Outside-in membrane module, operating temperature 5-40 ℃, Max. operating 8.5 bar; 3. Maximum osmotic flush (backwash) pressure:0.5-0.8 bar; 4. ID/OD: 0.50/0.98 mm (Comes with membrane shell of high-temperature resistance, which can operate at high temperature)					

Note: For engineering design parameters and information, please consult with our technical staff and obtain the latest version of the technical manual

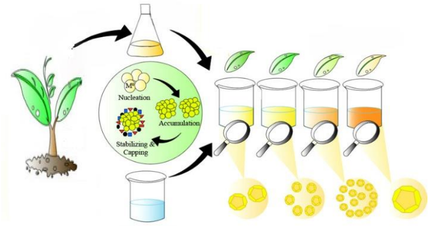
08 3ENF-60 NF MEMBRANE

Introduction

The 3ENF-60 nanofiltration membrane series has high water flux and medium desalination rate, widely used in wastewater treatment of dyeing and industrial/municipal wastewater rich in organic pollutants. It removes not only total dissolved solids but also biological pollutants, greatly improving permeate quality.

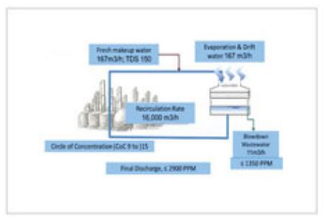
3ENF-60 has been applied for:

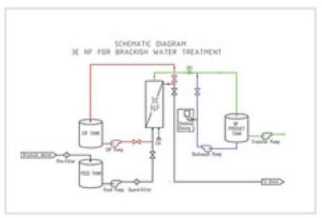
- ZLD: Efficient remove of ammonia-nitrogen and heavy metals in high concentration wastewater
- Cooling tower water recycle: reducing TDS, COD, chemical usage, increasing system CoC, reducing effluent amount
- Water reuse in industrial wastewater (UK)



Typical Applications

- wastewater recycle
- Material separation
- Textile wastewater treatment
- Colliery wastewater treatment
- Cooling tower wastewater recycle, etc.





Parameters

Mat'l	Module No. (size, mm)	Eff. Mem. Area: m²	Permeate Flow Rate m³/day	Salt rejection(%) 2000ppm $MgSO_4$	Max Free-chloride resistance; ppm	Max Opt. pressure / (Max pH range)
PES	3ENF-60m2012 (Ø200×1200)	35.0±0.5	20.7±3.0	65.0±5.0	1000	8.5 bar/(2-12)
	3ENF-60m2020 (Ø200×2000)	63.0±0.5	36.7±6.0	65.0±5.0	1000	8.5 bar/(2-12)
Test Conditions	1. Water temperature 25℃; pH 7.5-8.0, test pressure 4.8 bar; 2. Outside-in membrane module, operating temperature 5-40 ℃, Max. operating 8.5 bar; 3. Maximum osmotic flush (backwash) pressure:0.5-0.8 bar; 4. ID/OD: 0.50/0.98 mm (Comes with membrane shell of high-temperature resistance, which can operate at high temperature)					

Note: For engineering design parameters and information, please consult with our technical staff and obtain the latest version of the technical manual

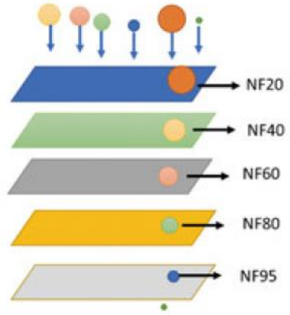
09 3ENF-80 NF MEMBRANE

Introduction

The 3ENF-80 NF membrane series has high rejection characteristics, exhibiting excellent separation performance in brackish water purification and wastewater reuse. Widely used in material separation and treatment of industrial and municipal wastewater rich in organic pollutants, it removes not only TDS but also biological pollutants, greatly improving permeate quality.

3ENF-80 has been applied for:

- Zero Liquid discharge: Efficient remove ammonia-nitrogen and heavy metals in high concentration wastewater with low energy consumption (Singapore).
- Reducing TDS and organic pollution, decreasing chemical usage, increasing cooling tower system CoC, and reducing discharge volume (Singapore).
- Industrial wastewater reuse (UK).
- Zero Liquid discharge of concentrated wastewater (Singapore).



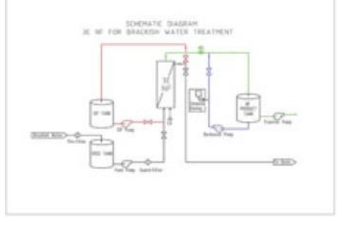
Typical Applications

- Material separation
- Wastewater treatment in food and beverage industry
- Brackish water treatment
- Cooling tower wastewater recycle
- Municipal wastewater reuse
- Boiler water purification
- Industrial wastewater reuse, etc

Parameters

Mat'l	Module No. (size, mm)	Eff. Mem. Area: m²	Permeate Flow Rate m³/day	Salt rejection(%) 2000ppm $MgSO_4$	Max Free-chloride resistance; ppm	Max Opt. pressure / (Max pH range)
PES	3ENF-80m2012 (Ø200×1200)	35.0±0.5	14.5±3.0	80.0±5.0	1000	8.5 bar/(2-12)
	3ENF-80m2020 (Ø200×2000)	63.0±0.5	25.7±6.0	80.0±5.0	1000	8.5 bar/(2-12)
Test Conditions	1. Water temperature 25℃; pH 7.5-8.0, test pressure 4.8 bar; 2. Outside-in membrane module, operating temperature 5-40 ℃, Max. operating 8.5 bar; 3. Maximum osmotic flush (backwash) pressure:0.5-0.8 bar; 4. ID/OD: 0.50/0.98 mm (Comes with membrane shell of high-temperature resistance, which can operate at high temperature)					

Note: For engineering design parameters and information, please consult with our technical staff and obtain the latest version of the technical manual



10 3ENF-90 NF MEMBRANE

Introduction

The 3ENF-90 membrane series is a cutting-edge nanofiltration (NF) technology designed to deliver superior water purification performance. This innovative membrane exhibits exceptional oxidation and contamination resistance, enabling reliable operation even in challenging water conditions. Its high rejection rate effectively removes a wide range of contaminants, including salts, heavy metals, and organic pollutants.

The 3ENF-90 series delivers high-quality drinking water with exceptional oxidation and fouling resistance. Ideal for residential, commercial, and industrial applications, it ensures reliable, continuous access to safe water. Choose the 3ENF-90 for efficient, durable water purification solutions tailored to your needs.

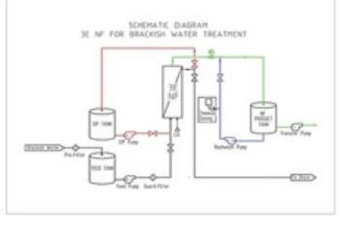
Typical Applications

- **Safe-healthy Drinking water**
- Material separation
- Brackish water treatment
- Municipal wastewater reuse
- Industrial wastewater reuse
- Cooling tower wastewater recycle
- Coal mine industrial wastewater treatment , etc.

Parameters

Mat'l	Module No. (size, mm)	Eff. Mem. Area: m²	Permeate Flow Rate m³/day	Salt rejection(%) 2000ppm $MgSO_4$	Max. cumulative active chlorine exposure; ppm-hours	Max Opt. pressure / (Max pH range)
PES	3ENF-90m2012 (Ø200×1200)	35.0±0.5	10.4±2.0	90.0±3.0	1000	8.5 bar/(2-12)
	3ENF-90m2020 (Ø250×2000)	63.0±0.5	18.4±3.0	90.0±3.0	1000	8.5 bar/(2-12)
Test Conditions	1. Water temperature 25ºC; pH 7.5-8.0, test pressure 4.8 bar; 2. Outside-in membrane module, operating temperature 5-40ºC, Max. operating pressure is 8.5bar 3. Maximum osmotic flush (backwash) pressure:0.5-0.8 bar 4. Fiber ID/OD: 0.50/0.98 mm (Comes with membrane shell of high-temperature resistance, which can operate at high temperature)					

Note: For engineering design parameters and information, please consult with our technical staff and obtain the latest version of the technical manual



11 3ENF ANTI-FOULING HF NF MEMBRANE

APPLICATION CASE 1

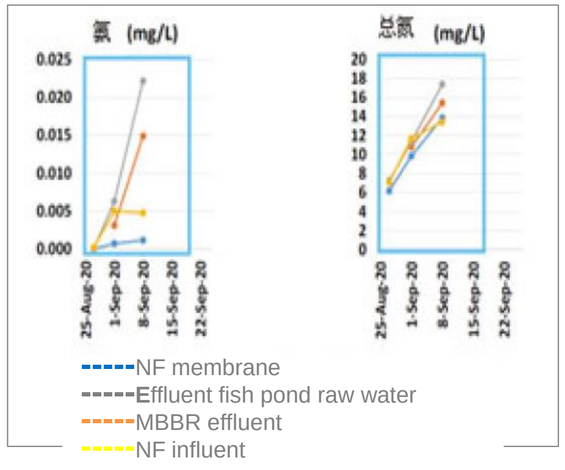
Singapore Uses 3ENF Membranes to Reuse Wastewater from Seawater Fish Farming

Singapore, the world's leading exporter of ornamental fish, faces ecological challenges from fish farm wastewater. To address this, the government plans to move all outdoor fish farms to indoor multi-level facilities and set water reuse standards. The government promotes new technologies to reduce wastewater reuse costs, conserving water and lowering farming expenses. After extensive evaluation, the 3ENF NF membrane received government recognition and funding. In collaboration with the Singapore Fish Farming Association, Aquarium Iwarna Marine Ornamental Fish Import and Export Company implemented the 3E-designed NF wastewater reuse system at their fish farm.

Parameters

- Raw water salt concentration: 38000.0 ppm; Water yield: 0.4±0.5 L/h
- Salt Rejection Rate: 20.0% (2000 ppm $MgSO_4$)
- Working pressure: 2.0 bar; Maximum operating pressure: 3.0 bar

Application Effect of 3ENF Membranes



Comparison of ammonia nitrogen content in reclaimed water treated with 3ENF system and MBBR

Why Use 3ENF Membranes?

- High operating pressure of existing reverse osmosis: 10.0-100.0 bar;
- The interception rate of NaCl by the existing NF and RO is too high, and the filtered water needs to be re-mixed with NaCl before it can be used for marine fish farming.
- The existing NF and RO membranes need very clean inlet water to avoid system pollution, and the 3E-NF membrane system can directly draw water from the fish pond, which reduces equipment investment and operating costs;
- The existing NF and RO are very sensitive to the pollution of green algae in seawater; The 3E-NF membrane is more stable due to the fact that the system can be removed by a variety of methods, including backwashing

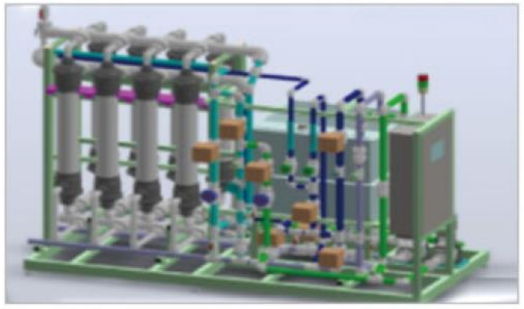
APPLICATION CASE 2

Hydrasyst in the UK Uses 3ENF Membranes to Reuse Laundry Wastewater

Laundry water accounts for at least 20% of domestic water usage, and large-scale laundries consume vast amounts of precious drinking water. If this wastewater is directly discharged into sewers, it not only burdens industrial wastewater treatment but also exacerbates the issue of water scarcity. Many Western countries now prohibit direct discharge of laundry wastewater and have set standards for its reuse. To achieve these goals, governments encourage the adoption of new technologies to reduce the cost of recycling laundry wastewater and decrease water consumption in laundries, ultimately lowering operational costs.

UF-RO System

Hydrasyst, a renowned industrial wastewater treatment company, has recognized the effectiveness of 3E NF membranes through comparative studies and experiments. 3E's NF wastewater recycling system has been successfully implemented in Hydrasyst's laundry wastewater treatment and reuse projects.



3E-Hydrasyst Reuse System

Parameters

- Processing capacity: 4.0±0.1 tons/hour; inlet TDS 2400ppm
- Salt Rejection Rate: 60.0% (2000ppm $MgSO_4$)
- Working pressure: 2.5 bar
- Maximum working pressure: 3.0 bar

Why Use 3ENF Membranes?

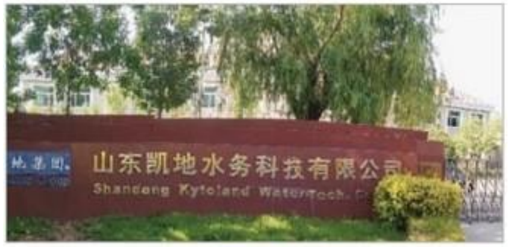
- Existing RO membrane has high operating pressure: 10-100bar;
- Existing NF and RO membranes need very clean inlet water to avoid pollution by the spiral membrane system, and the 3ENF membrane can directly draw water from the sewage pool, which reduces the equipment investment and operating costs;
- Existing NF and RO membranes are very sensitive to scaling and biological contamination; The 3E-NF membrane can remove biological and other contamination by a variety of methods, including backwashing, so the system operation is more stable;
- Simplify the treatment process of existing laundry wastewater, so that the reuse of laundry wastewater becomes reliable, easy to operate and practicable.



APPLICATION CASE 3

Shandong Kaidi Water (KWT) Uses 3E-NF Membrane to Realize Reclaimed Water Reuse

In order to reduce the demand for tap water in Anqiu Thermal Power Plant and protect valuable drinking water resources, Shandong Kaidi Water decided to use the 3E NF-RO reclaimed water reuse system to reuse the reclaimed water of its water plant that meets the discharge standards after careful investigation in 2020, and use it as the inlet water of the cooling tower of the thermal power plant after reaching the standard. The NF-RO reclaimed water reuse system designed by 3E is the company's first reclaimed water reuse project, significantly reducing the company's operating costs.



Parameters

- Processing capacity: 2000.0 tons/day
- Inlet water quality: up to standard reclaimed water
- Salt Rejection Rate: 5.0% (2000ppm $MgSO_4$)
- Water flux: 40.0 LMH/bar
- Working pressure: 2.5 bar; Maximum operating pressure: 3.0 bar

Why Use 3ENF Membranes?

- Most existing UF membranes have a loose structure with high molecular weight cut-off (around 150k-300kDa), unable to remove hardness and organic matter, failing to mitigate scaling and fouling of subsequent reverse osmosis membranes, resulting in high system maintenance costs.
- 3E's high-flux NF membrane offers similar flux to UF membranes from other brands but with a dense surface resistant to fouling. It can intercept hardness and organic pollutants, reducing scaling and fouling of reverse osmosis membranes for stable system operation and low maintenance costs.
- 3E nanofiltration membranes can remove biological and other contaminants through methods like backwashing, with usage conditions similar to general ultrafiltration membranes.
- 3E nanofiltration membranes enable more economical, reliable, stable, and feasible reclaimed water reuse from municipal wastewater.

APPLICATION CASE 4

Shandong Feicheng Water Company Uses 3E-NF Membrane to Realize Reclaimed Water Reuse

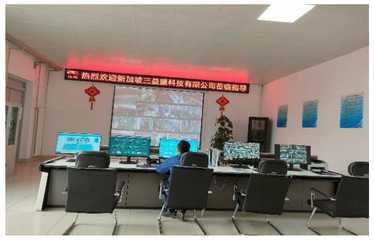
After a six-month pilot study, Feicheng Water Company decided to adopt 3ENF-01 technology in their new 10,000-ton drinking water plant, replacing traditional ultrafiltration as pretreatment for reverse osmosis membranes. This decision aims to enhance system stability and reduce operational costs for drinking water production. The application of 3E-NF01 technology is expected to provide Feicheng Water with a more efficient and economical water resource management approach.

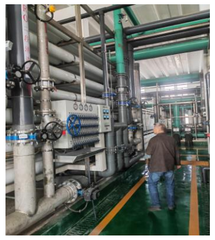
Parameters

- Processing capacity: 10,000.0 m^3/day
- Inlet water quality: river water
- Salt Rejection Rate: 1.0% (2000ppm $MgSO_4$)
- Design flux: 40.0 LMH/bar
- Working pressure: 1.0 bar; Maximum operating pressure: 2.0 bar

Why Use 3ENF Membranes?

- Most existing UF membranes have a loose structure with high molecular weight cut-off (around 150k-300kDa), unable to remove hardness and organic matter, failing to mitigate scaling and fouling of subsequent reverse osmosis membranes, resulting in high system maintenance costs.
- 3E's high-flux NF membrane offers similar flux to UF membranes from other brands but with a dense surface resistant to fouling. It can intercept hardness and organic pollutants, reducing scaling and fouling of reverse osmosis membranes for stable system operation and low maintenance costs.
- 3E nanofiltration membranes can remove biological and other contaminants through methods like backwashing, with usage conditions similar to general ultrafiltration membranes.
- 3E nanofiltration membranes enable more economical, reliable, stable, and feasible reclaimed water reuse from municipal wastewater.

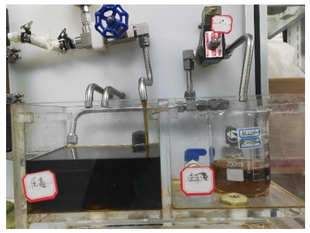




Application and Pilot Study Progress

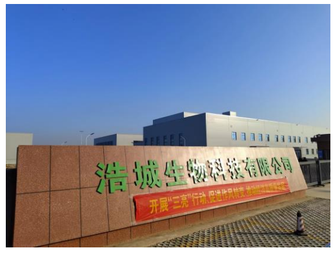
Zhucheng Haotian Pharmaceutical Co., Ltd：stevia solution purification

Haotian Pharmaceutical Co., Ltd. specializes in natural plant-based raw materials. In June 2023, the company began testing 3E technology for purifying stevia solutions. After nearly a year, the pilot test succeeded on May 19, 2024. Currently, Haotian and 3E are progressing with the project's detailed design.




Haocheng Biotechnology C/L: Corn protein and polysaccharide peptide purification

Haocheng Biological Co., Ltd produces corn gluten and polysaccharide peptides. To address industry challenges like moisture absorption and low purity, the company is trialing 3E technology for purification projects. Currently, the project is progressing well.





Shandong Yamei Technology C/L. - Zero Liquid Discharge (ZLD)

Shandong Yamei Technology C/L :successfully piloted 3E NF membranes for ZLD of wastewater, confirming the reliability of this technical solution for future projects.




（5）水样进检水质结果

	CODcr (mg/L)	硬度 (mg/L)	硫酸根 (mg/L)	电导率 (μs/cm)	浊度 (NTU)	PH
进水	282	-	9236	17360	67.7	7.49
产水	192	-	8603	16560	8.3	8.16
脱除率	31.91%	-	7.12%	4.61%	87.74%	

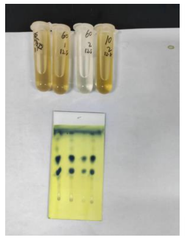
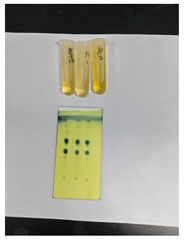
China Saline-alkali Land Comprehensive Utilization Technology Innovation Center - Sweet Sorghum Juice Extraction and Purification

On May 12, 2024, the Centre introduced 3E technology to conduct the test of sweet sorghum juice extraction and purification project, and the pilot test has been successfully completed and the project design has begun



Shandong Longchang Animal Health Products C/L: bile acid purification and filtration

Shandong Longchang Animal Health Products Co., Ltd. is China's largest bile acid manufacturer and industry standard setter. Currently, the domestic active ingredient standard is 50%, with plans to raise it to 70% using 3E's nanofiltration technology. In December 2023, they began testing bile acid purification, and the project is progressing well, aiming to become the world's largest bile acid production base.

Anqiu Tiantian Lemon Biochemical Project Wastewater Material Recovery and Wastewater Recycle

The 3E HF NF membrane pilot equipment has successfully tested continuous operations in four applications: MVR water purification, wheat starch purification, sodium citrate filtration, and citric acid broth purification, all recognized and adopted by customers.



Plate-and-frame Permeate water

3E NF permeate water

Pilot site