Ion exchange membranes for water purification

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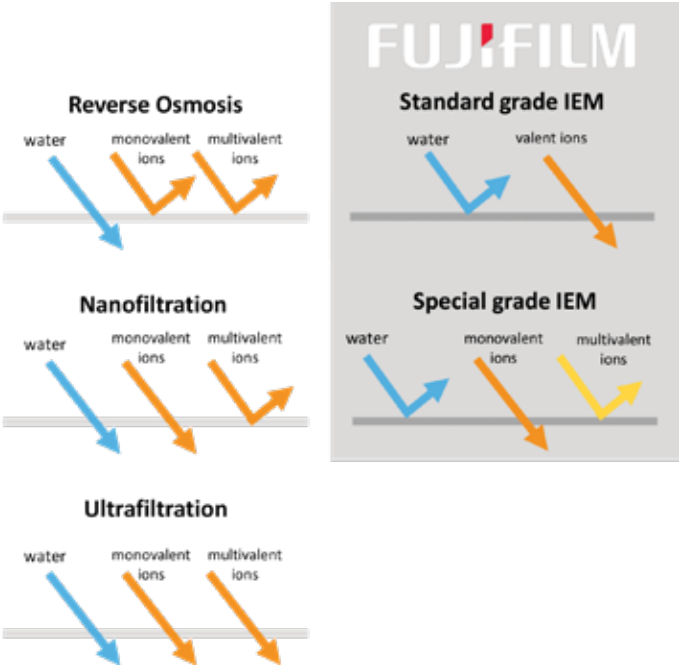
Ion Exchange Membranes for water purification

Introduction

Fujifilm's development of membranes is continuously on the move. We develop and produce top quality ion exchange membranes (IEM) that may suit a variety of applications and industries. We focus on high volume supply of cost effective ion exchange membranes which enable breakthrough membrane processes. For this we work together with related industry partners where needed, to move the industry forward.

Fujifilm membranes can be used in several electro separation technologies. As each technology has its own focus area and requirements (fresh water production, waste water concentration, energy generation or water softening), Fujifilm developed a membrane portfolio to suit its customers needs ranging from low electrical resistance membranes, broad pH range membranes to low water permeating membranes. Our thin homogeneous anion and cation exchange membranes are based on patented new innovative polymer technology.

Membrane types and purposes



Salt production	• Salt production from seawater
Food / Pharmaceuticals	Desalination of: • soy sauce • amino acids • plum seasoning and plum vinegar • organic acids • carbohydrate solution • cheese whey • intermediate for medicines Stabilization of wine
Drinking water production	• Desalination and removal of hardness from underground water • Removal of nitrate bromide and fluoride from underground water

Waste solution treatment	• Desalination / concentration of leachate from landfill • Desalination / concentration of waste solution (from manufacturing process of semiconductors / metals)
Acid / Alkali recovery	Acid recovery of: • aluminium plate pickling process • aluminium foil pickling process • metal pickling proces • Recovery of alkali waste solution
Other applications	• Production of ultra pure water • Membrane for batteries • Desalination of deep sea water • Recovery of plating solution • Recovery of Amine

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Fujifilm's Ion Exchange Membrane selection

Fujifilm has a broad range of ion exchange membranes in its commercial portfolio and development track ranging from standard grades to special grades.

Standard grades IEM

TYPE 1
Low power consumption & medium water permeating membranes. Most used applications are for water softening by Capacitative Deonisation (CDI) technology.

TYPE 2
Medium power consumption & low water permeating membranes at 4-10 pH range. Most used applications are for purifying process / waste water concentration / brackish water streams by ElectroDialysis (ED) technology.

TYPE 10
Low power consumption & medium water permeating membranes at 1-13 pH range. Most used applications are for purifying process / waste water / brackish water / food streams by ElectroDialysis (ED) technology.

Special grades: on request

Storage and handling

For optimal performance Fujifilm membranes are delivered in dry state or pre-conditioned, on a roll or in sheets. The membranes must be stored at temperatures between 15°C and 25°C. The membranes must be kept in the closed sealing bag until ready for use. Membranes need preconditioning prior usage.

For detailed information check out the specific article information sheets

Pre-cut sheets

Dry roll

Available membrane dimensions and formats

- Dry roll: 125m length, 0.53 m width (5-6% swelling after pre-conditioning)
- Pre-conditioned roll: 125m length, 0.53m width
- Pre-cut sheets: 25 pcs per box, customized dimensions, maximum width 0.53m
- Certifications: NSF (optional), Food (optional)

FUJIFILM MEMBRANES	TYPE 1		TYPE 2		TYPE 10	
Homogeneous	AEM	CEM	AEM	CEM	AEM	CEM
	Anion permselective	Cation permselective	Anion permselective	Cation permselective	Anion permselective	Cation permselective
Reinforcement	polyolefin		polyolefin		polyolefin	
Thickness dry (µm)	125	135	160	160	125	135
Resistance Ω cm2 (1)	1.3	2.7	5	8	1.7	2.0
Perm selectivity (2)	92	92	95	96	95	99
Water permeation (3)	14	13	3.0	3.5	6.5	6.5
Burst strength (4)	2.4	2.7	5.0	4.7	2.8	2.8
pH stability	pH 2-10	pH 4-12	pH 2-10	pH 4-12	pH 1 -13	
Temp stability (5)					60	
Typical applications	water softening seawater to brackish water		purifying process water concentrating waste water brackish to potable water		purifying process water concentrating waste water sea & brackish to potable water food desalination	
Typical technology	ElectroDialysis Reversal (EDR) Capacitive Deionisation (CDI)		ElectroDialysis Reversal (EDR) Electro Deionisation (EDI)		ElectroDialysis Reversal (EDR)	

** The property values are typical values only and no waranty as to such properties is given*

(1) Electrical resistance measured at 0.5M NaCl
(2) Permselectivity measured at 0.05-0.5M NaCl
(3) Water permeation (ml/bar.m2 .hr)
(4) Burst strength (kg/cm2)
(5) Temperature (Celcius)

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E-Separation Technology examples based on Fujifilm's ion exchange membranes

ElectroDialysis (ED) is a DC voltage-driven membrane process. An electrical potential is used to move salts through a membrane, leaving desalinated water behind as product water.

ED depends on the following general principles:
Most salts dissolved in water are ions, either positively charged (cations), or negatively charged (anions).
Since like poles repel each other and unlike poles attract, the ions migrate toward the electrodes with an opposite electric charge.
Suitable membranes can be constructed to permit selective passage of either anions or cations.

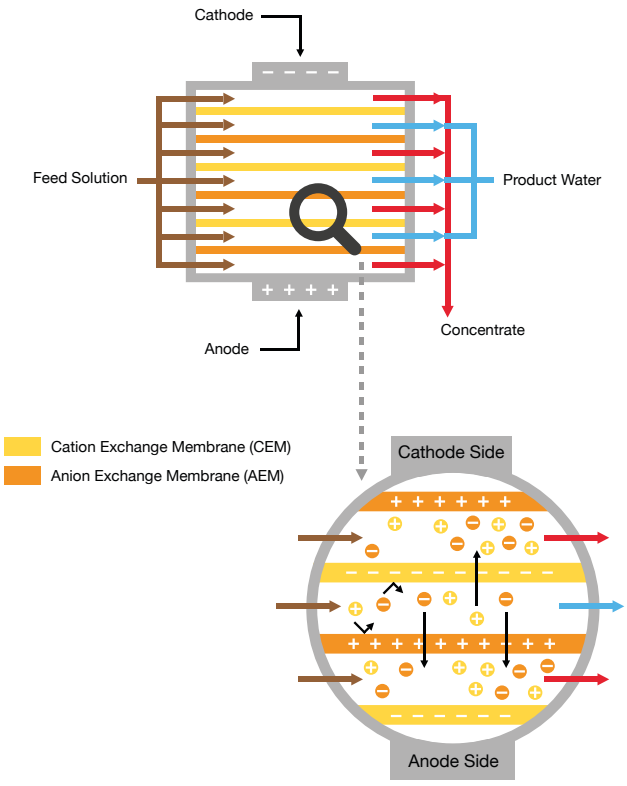
In a saline solution, dissolved ions such as sodium (+) and chloride (-) migrate to the opposite electrodes passing through selected membranes that either allow cations or anions to pass through (not both).

Membranes are usually arranged in an alternate pattern, with anion-selective membrane followed by a cation-selective membrane. During the desalination process, the salt content of the water channel is diluted, while concentrated solutions are formed in the adjacent channels.

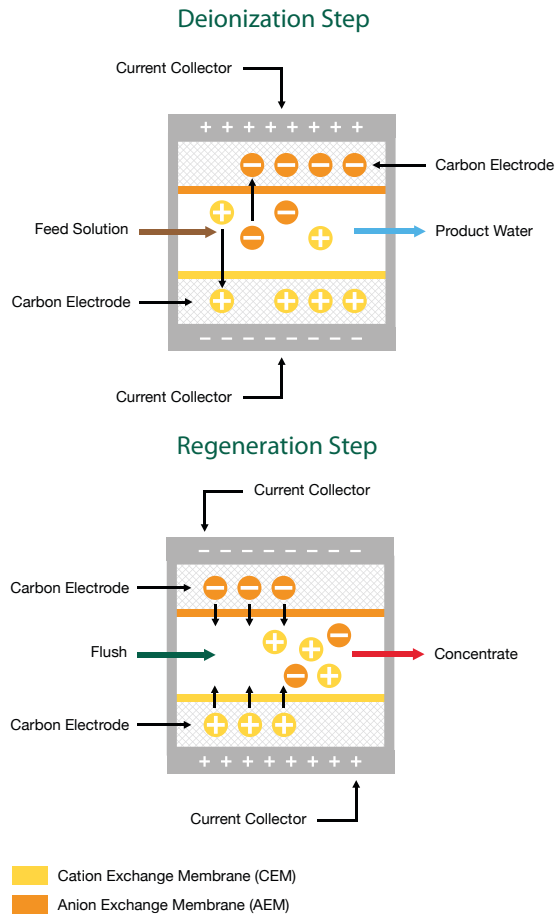
Concentrated and diluted solutions are created in the spaces between the alternating membranes, and these spaces bound by two membranes are called cells. ED units consist of several hundred cells bound together with electrodes, and is referred to as a stack. Feed water passes through all the cells simultaneously to provide a continuous flow of desalinated water and a steady stream of concentrate (brine) from the stack.

Another electro separation process which uses ion exchange membranes is for example Capacitive Deionization, see basic principle below.

Electro-Dialysis (ED)



Capacitive Deionization



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Membrane Production

Fujifilm Manufacturing Europe B.V. in Tilburg, The Netherlands produces membranes and modules for water purification and gas separation.

This company site covers 63 hectare and has 3 production plants. With more than 800 employees this is one of the largest Fujifilm production facilities of photographic and membrane materials.

R&D Membrane laboratories

Fujifilm has two corporate R&D laboratories related to membranes:

1. Advanced Research Laboratory in Tokyo, Japan which includes the Synthetic Organic Chemistry Lab (SOCL) for high performance polymer technology and Highly Functional Materials Research Lab (HFMRL) for innovations in coating technology

2. The Tilburg Research Laboratory is located at the production site of Fujifilm Manufacturing Europe B.V.

Our R&D Centre in Tilburg has an excellent analytical laboratory. This laboratory supports customer and application activities relating to our ion exchange membranes and gas separation membranes.

The laboratory provides fast and secure root cause analysis. For the evaluation of membrane properties and membrane performance, an extensive set of validated test methods is available, such as:

- Perm selectivity
- Electrical resistance
- Ion exchange capacity
- Water permeation

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versionnumber 1.1 - 2018

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