151-5, Gwahaksaneop 4-ro, Heungdeok-gu,
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www.airrane.com



AIRRANE

2023.10

AIRRANE



Gas Membrane Specialist for Separation

www.airrane.com



AIRRANE

Airrane provides solutions for air and gas fields using gas separation membrane technology.

Since the Company founded in 2001, Airrane has been a leader in gas separation membrane manufacturing in Korea for over 20 years. Based on innovative corporate culture and continuous R&D efforts, we are expanding our participation in the global market through customized product design.

Airrane provides the market with a technology to separate gases such as carbon dioxide, methane, nitrogen, oxygen, hydrogen, and helium with high purity through self-developed gas separation membrane products. We aim to develop innovative solutions for Environment and Energy issues that world is facing and especially focus on carbon neutralization using membrane carbon capture technology.

Airrane has business with customers in various industries such as Oil & Gas, Energy, Biogas, Petrochemical, Electronics, Marine, Aircraft, Agriculture, and Logistics. As a technological innovation company, Airrane will become a company that provides solutions that meet the rapidly changing needs of customers. Thank you.

CEO & President **Dr. Seong-Yong Ha**

History

2001. 03 Established AIRRANE Co., Ltd.
2001. 04 Certificate of Venture Company
2001. 09 Membrane Factory and R&D Center Opening
2003. 06 Certificate of EM Mark
2005. 08 Business collaboration with Asahi glass Engineering
2006. 11 Business collaboration with Air Products
2007. 05 Certificate of INNO-BIZ
2007. 10 Energy Technology Prize awarded from Ministry of Trade, Industry & Energy
2009. 07 Certificate of New Technology Company from Ministry of Science
2014. 06 Headquarter relocation to Ochang Industrial Park
2018. 05 Certificate of ISO 9001 & 14001: 2015
2019. 06 Commercialize High Pressure Membrane
2019. 07 Participated in UK AD & Biogas Exhibition
2019. 10 NEP (New Excellent Product) registration for Biogas upgrading membrane
2020. 12 Halla Group investment and shareholder registration
2021. 11 Lotte Chemical Investment and shareholder registration
2022. 03 POSCO investment and shareholder registration
2022. 05 SKI & SKIET investment and shareholder registration

CEO Profile

- **1994~1996** Researcher, Korea Institute of Science and Technology
- **2001~** CEO and President of Airrane Co., Ltd.
- **2007** Awarded from Minister of Trade, Industry and Energy
- **2009** Awarded from The Membrane Society of Korea, Membrane Manufacturing Division
- **2019~** Member of Human Rights Management, Korea Gas Technology Corporation
- **2020~** Vice President of The Membrane Society of Korea, A member of North American Membrane Society (NAMS)



AIRRANE



Material Synthesis & Fiber Spinning 1

- Polymer Synthesis
- TIPS/NIPS Equipment
- Hollow Fiber Spinning

2 Module Production

- Module Design & Development
- Customization for Integration
- Manufacturing

3 Membrane Separation System

- Feasibility Study
- System Design & Development
- Installation & Optimization
- Testing & Evaluation
- Maintenance

Airrane, a gas separation membrane specialist, operates 3 business pillars including hollow fiber membrane fabrication, membrane module manufacturing, and membrane system Engineering. Airrane is positioning itself as a one-stop service provider in gas separation field. Since its establishment in 2001, the company's vision is to become a sustainable eco-friendly energy solution company in the gas separation membrane field through continuous innovation.



Why AIRRANE ?

On-Demand Customization

AIRRANE is unrivalled in its ability to provide site-tailored solution regardless of size, quantity or specification requirements. In addition to its wide range of standard products, AIRRANE is always willing to offer customized systems at competitive rates to meet clients' varied needs in a timely fashion.

Proven Technology & Innovation

AIRRANE's solid track record of over 20 years has been built through sustained partnerships with our loyal clients. Endless tests and improvements, combined with continued investment in R&D, have equipped AIRRANE with a strong portfolio of patent-protected products and solution

Expert Team - Comprehensive Service

AIRRANE's passionate team of R&D experts (including 4 Ph. Ds) respond to the client's requirements with the very best of their experience and expertise. From the design and manufacturing of fully tailored solutions to operational training and consulting services, AIRRANE serves as your one-stop provider for all your gas separation requirements.

Local Strength

AIRRANE has successfully established its presence in the Asia-Pacific region. AIRRANE's unrivalled understanding and experience of the local market adds to its competitive offering of cost-effective and well-integrated solutions. AIRRANE has exported its products and systems to more than 20 countries, including China, Japan, Russia, Australia, Turkey, U.K. and the USA.

Quality Assurance

As a result of continued dedication to technological innovation and quality control, AIRRANE's membrane products have acquired performance and quality certifications from leading authorities in Korea and beyond:

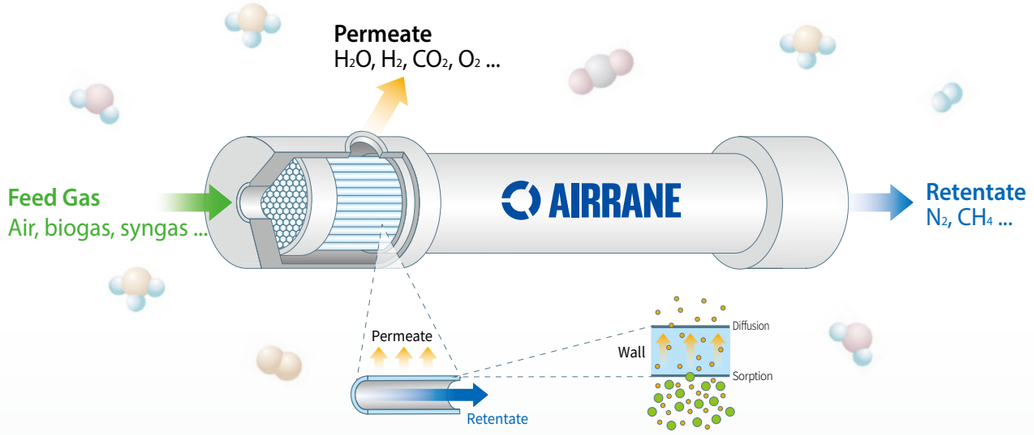
- ISO9001/ISO14001 Certificate
- Separation performance of polymer membrane (KOPTRI)
- Separation performance of hollow fiber membrane (KTL)
- Mechanical properties of hollow fiber membrane (KRICT)
- CE certificate

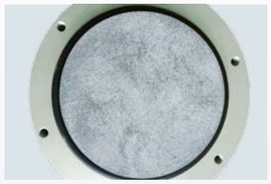
In addition, AIRRANE provides year-round technical assistance for all its products and solutions on top of routine inspections and maintenance visits.

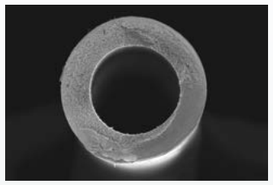


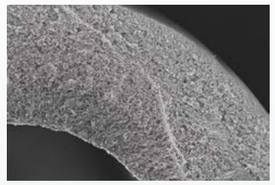


Principle of Membrane Technology

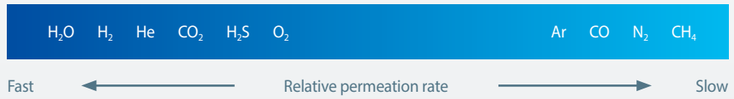












Gas separation membranes are very fine hollow fibers through which different mixtures of gases are fed. As the gases travel through the tubes, a process called selective permeation (Diffusion-Sorption) allows us to separate gases using.

At a closer look, gas separation membrane, the wall of each of these micro-thin hollow fibers, is an asymmetric filter made of various types of polymers. As different gases travel through the fiber, they come into contact with the membrane and permeate through it.

The permeation rate of each gas is determined by its solubility in the membrane material and its diffusion rate. Gases with higher solubility and smaller molecules (fast gases) can pass through the membrane faster than other less soluble gases with generally larger molecules (slow gases). Gases which permeate faster and more are collected outside of the hollow fiber as permeates while gases which do not permeate so well and stay inside of the fiber until they reach the other end are separated out as retentates. Depending on the properties of the desired gas, either or both of permeates and retentates can be used.

For instance, if we want to separate methane from carbon dioxide for biogas upgrading, we feed biogas through the membrane filter.Since carbon dioxide (CO_2) permeates through the membrane much faster than the heavier methane (CH_4), we get carbon dioxide concentrated out of the membrane fiber as permeate and methane staying inside the hollow fiber as retentate; methane is then collected at the end of the membrane.

Benefits of Membrane Technology

Economic Solution

- Low capex and operational cost
- Short installation time
- Low maintenance cost

Durability of Membrane

- Long lifetimes of membrane
- Little influence by weather and climate

Simple and Reliable System

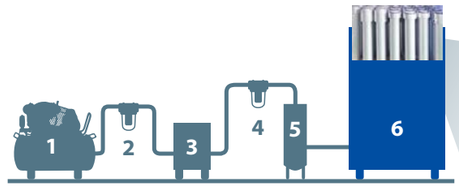
- Compact system with small space requirement
- Low maintenance requirements
- Easy to start and stop operation at short intervals

Environmental and Safety Benefits

- No chemical process
- No environmental emissions, no wastewater or absorbent
- Less handling/operational risks



Membrane Separation Process



1. Compressor
2. Liquid Separator
3. Dryer
4. Coalescing Filter
5. Activated Carbon Bed/Filter
6. Membrane Module

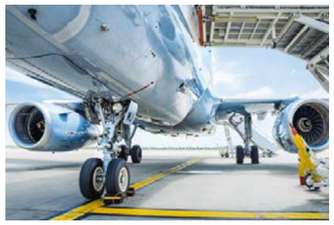


Industries & Applications

Nitrogen Generation

Nitrogen is one of the most widely used industrial gas with versatile applications like blanketing,inerting and explosion protection. On-Board Inert Gas Generation System (OBIGGS) produces nitrogen gas to protect fuel tanks on aircrafts and ships from the risk of fuel vapor explosion.

- Fuel tank inerting : OBIGGS
- Shipboard inerting (FPSO, FLNG, LNG Carrier)
- Chemical processing
- Iron/aluminum/copper production and metals processing
- Tire inflation for long range driving truck and bus
- Laboratory equipment
- Anti-frost inerting for H_2 fueling station

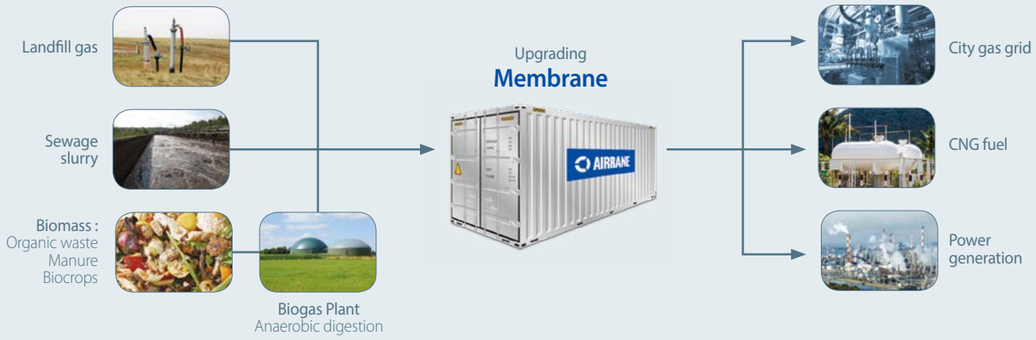




Biogas Upgrading

Fermentation of biomass such as food waste, farm manure and sewage slurry produce biogas. Typically, crude biogas is a mixture of about 60% methane (CH_4), 40% carbon dioxide (CO_2), and a small amount of trace gases such as hydrogen sulfide. The pre-treated biogas goes through gas separation membrane to yield biomethane of a much higher purity (over 97%) for supplying LNG grid and CNG vehicle fuel.

- Food waste, Farm manure, Brewery waste
- Sewage slurry
- Landfill gas



Energy and Steel

Power generation and Steel industry require a reliable and cost-effective solution for the control of various gases. Gas separation membrane could be reasonable answer for many of those challenges, reducing CO_2 emission from stacks, versatile applications in H_2 production and fuel cell power generation, improving fuel efficiency with oxygen-enriched air, ensuring safety through nitrogen purging systems.

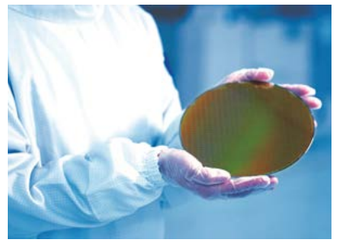
- CO_2 Capture& Utilization for flue gas
- O_2 generation for oxyfuel combustion
- H_2 purification for fuel cell power generation
- SMR CO_2 capture for Blue H_2 production



Semiconductor & Display

Semiconductors and display panels manufacturing require high-purity gas control. Even wastewater containing IPA or SF6 can be treated with gas membrane to produce more concentrated IPA or SF6 solutions which can be recycled and generate additional revenue.

- IPA/Hydrochloric acid purification for recycling
- Oxygen/Carbon dioxide/Nitrogen controlling for de-ionized (DI) water
- Anti-static treatment for ultrapure water
- Clean room for ultra-fine dust removal



Food & Beverage

Long-distance transportation and prolonged shelf-life requirements have made nitrogen an essential part of the food and beverage industry. AIRRANE is also working to provide solutions which control a variety of gases to revolutionize the taste of our everyday foods and drinks.

- Modified atmosphere packaging (MAP)
- Storage tank blanketing and water treatment
- Controlled atmosphere (CA) transport and storage
- Carbonation for beer and sparkling wine
- Nitrogen coffee and beverages



Health Care & Air Quality Control

From humidity control and oxygen generation systems at hospitals to air purifier and oxygen generator at home, an increasing demand for air quality control will be met with gas membranes.

- Air dryer
- Micro dust free air purifier
- Humidity controller
- Portable oxygen concentrator



Oil & Gas

For CO_2 removal from natural gas to the recovery of hydrogen in oil refinery process, gas membrane offers a cost-effective and energy-efficient solutions for a wide range of applications in oil & gas industries.

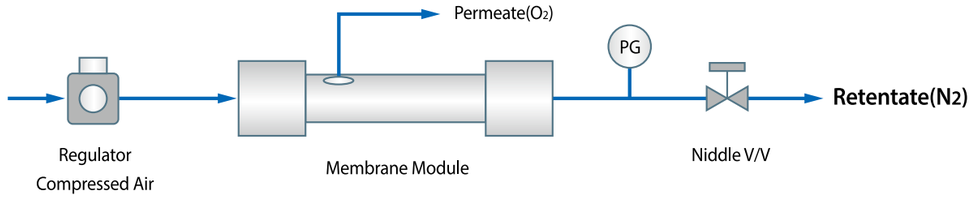
Natural Gas
- Nitrogen CO_2, H_2S Removal
- Enhanced oil/natural gas recovery
- Offshore nitrogen generation.

Refinery
- Hydrogen recovery from syngas process
- CO_2 removal from syngas
- Steam generation with enriched oxygen air

Petrochemical
- Hydrogen Purification
- Recovery of monomer & solvent from EO, PE, PVC process

Meritair® Nitrogen Generation Membrane

Schematic Diagram



Essential to a wide range of industrial processes and mechanical operations, securing a cost-efficient nitrogen gas is often an integral part of system engineering. However, conventional methods such as high-pressure cylinders, liquid tanks and bulk storage involve significant logistical issues and increase costs. Membrane separation presents an economic alternative which enables on-site nitrogen generation from the ambient air.

Key Applications



Fuel Tank inerting for Aircraft (OBIGGS)



CA container



Shipboard Inerting (FPSO, FLNG, LNG Carrier)



Food Processing and Packaging



Chemical Processing



Preventing oxidation in manufacturing



LNG Tank Repair, Maintenance



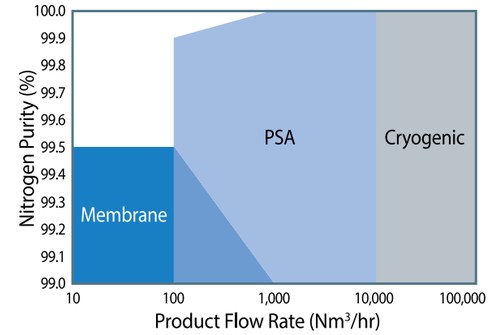
Hydrogen fueling station

AIRRANE Product Specifications

Model Number	Dimension (mm)			Connection (inch)			Weight
	L	OD	ID	Feed	Retentate	Permeate	
MNH-1512A	359	55	50	3/8"	3/8"	1/4"	0.9kg
MNH-2022A	589	70	60	3/8"	3/8"	3/8"	1.9kg
MNH-3032A	856	110	85	1/2"	1/2"	1/2"	6.0kg
MNH-4160A	1564	160	125	1"	1"	1"	19kg
MNH-6160A	1580	200	157.5	1.5"	1.5"	1.5"	26kg
MNH-8140A	1080	280	220	1.5"	1.5"	2"	44kg
MNH-8160A	1580	280	220	1.5"	1.5"	2"	55kg

Why Membrane for Nitrogen?

- Only requires compressed air to provide high-concentration nitrogen
- Mobile unit to easily move the places of installation
- No noise as separation can be carried out continuously
- Compact size requires minimal space
- Installation flexibility either vertically or horizontally



Technology Comparison

Method	Cryogenic	PSA	Membrane
Installation Costs	High	Mid/Low	Mid/Low
Operational Responsive	Irresponsive	Irresponsive	Responsive to operational fluctuations (concentration, flow volume, pressure)
Applications	Large-scale / Fixed	Mid-scale / Fixed	Mid-to-small-scale / Fixed & Mobile
Mobility	Immobile	Immobile	Mobile
Features	• High concentration (99.999%) • Requires high-pressure gas operation permit and qualified operator • Inappropriate for small-scale operation	• Relatively high concentration (98~99.999%) • Requires outdoor tank • Vulnerable to movement or vibration	• Ideal for lower concentration needs (95-99.5%) • Simple and small device • Can be operated unmanned • No risk of explosion • Unaffected by movement or vibration
Product Concentration	99.999%	99.99%	99.5%
Maintenance Costs	Middle	High	Low

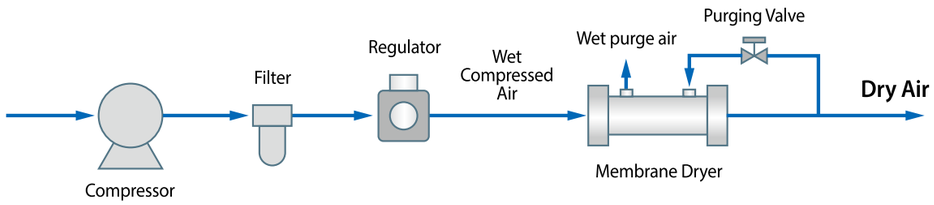






Meritair® Dehumidification Membrane

Schematic Diagram



Water is essential to life, but water vapor in air can be damaging to many facilities and processes. From pharmaceutical plants to electronical and chemical manufacturing, food and beverage production and medical equipment, the need for dehumidification is almost universal across all industries. Membrane separation is widely employed as a drying method of choice for its versatility and economic efficiency. Able to cover a broad range of varying conditions and requirements, membrane technology is fit to be your first option for dehumidification.

Key Applications



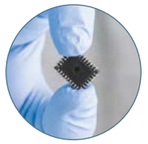
Low-dewpoint instrument



Drying powder products



Pneumatic Equipment



Dehumidification for Semi-conductor production



Pressurization for electronic cabinets



Dehumidified compressed air for Painting Process



Scientific research equipment & Analytical process



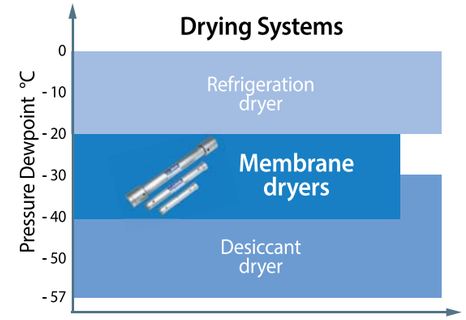
Medical equipment

AIRRANE Product Specifications

Model Number	Dimension (mm)			Connection (inch)			Weight
	L	OD	ID	Feed	Retentate	Permeate	
MMD-1307A	214	45	40	1/4"	1/4"	1/4"	0.4kg
MMD-1512A	359	55	50	1/2"	1/2"	1/4"	0.9kg
MMD-1522A	589	55	50	1/2"	1/2"	1/4"	1.3kg
MMD-2022A	590	70	60	1/2"	1/2"	3/8"	1.9kg
MMD-3032A	856	110	81	1"	1"	1/2"	6.0kg

Why Membrane for Dehumidification?

- Easy and versatile installation in all positions
- Immediate operation without any lag time
- Low energy consumption without additional power supply
- Uninterrupted operation cycle
- Eco-friendly process without CFCs/FCs
- Minimal maintenance requirement



Technology Comparison

Method	Desiccant	Refrigeration	Membrane
Dehumidifying Performance	High	Low	Mid-High
Dew Point	-30 – -57°C	0 – -20°C	-20 – -40°C
Installation Area	Large	Large	Small
Maintenance Requirement	Middle	Middle	Easy
Device Size	Small - Large	Small - Large	Small - Middle
Components	Tower / Tank / Heat Exchanger	Refrigerant / Condenser / Heat Exchanger	Separation Membrane / Filter

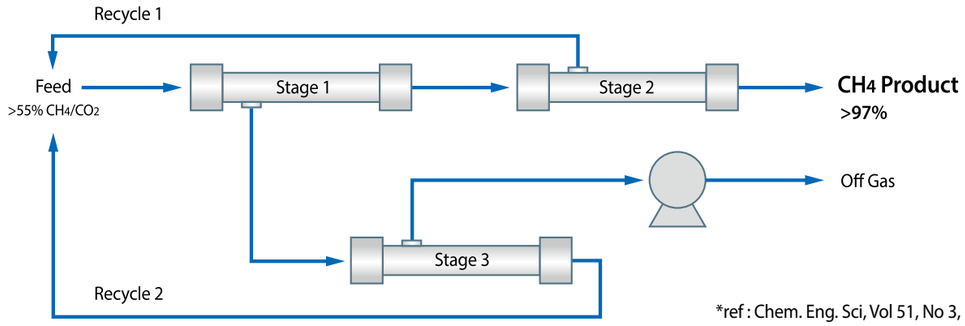






Meritair® Biogas Upgrading Membrane

Schematic Diagram



*ref : Chem. Eng. Sci, Vol 51, No 3, 1996

Biogas, which has recently been attracting attention as a next-generation eco-friendly fuel, is a clean renewable energy source and is recognized as a resource that can replace natural gas in power generation and vehicle fuels. Biogas is generated from food waste, manure, sewage treatment facilities, and landfills. Biogas is generally composed of 60% methane (CH_4) and 40% carbon dioxide (CO_2). Biogas can be converted into biomethane with a methane purity over 97% through a gas separation membrane and injected into a gas grid or fueled in CNG vehicles.Recently, the Korean government is promoting the production of hydrogen from biomethane, which is additional business opportunity for gas separation membrane industry. Airrane has already supplied several biogas upgrading facilities using the membrane system to Chungju, Uijeongbu, Paju, and Asan in Korea through collaboration with the government, and is currently participating in many future biogas upgrading projects in major cities.

Key Applications



Food Waste Processing Plant



Landfill Site



Wastewater Processing Plant



Waste Management Facility at Brewery



Slurry & Manure Processing at Farms



Crops and Residue from Agricultural Production

AIRRANE Product Specifications

Model Number	Dimension (mm)			Connection (inch)			Weight
	L	OD	ID	Feed	Retentate	Permeate	
MCH-3032A	856	110	85	1/2"	1/2"	1/2"	6.0kg
MCH-4040A	1080	150	114	1"	1"	1"	15kg
MCH-4160A	1564	160	125	1”	1”	1”	19kg
MCH-6160A	1580	200	157.5	1.5”	1.5”	1.5”	26kg
MCH-8140A	1080	280	220	1.5"	1.5"	2"	44kg
MCH-8160A	1580	280	220	1.5"	1.5"	2"	55kg

Why Membrane for Biogas?

- Does not require frequent replacement of chemical ingredients that causes secondary waste
- Can operate in wide range of operational pressure
- Less pressure loss for biogas upgrading
- Simple operation and low maintenance requirements
- Flexible operation depending on generated gas amount
- Possible to install for small-scale operation
- Compact size only requires minimal space
- Easy up-scaling

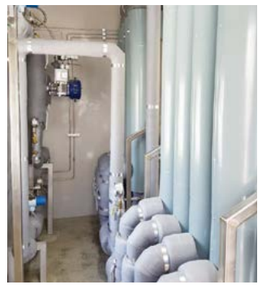


Installation size between competing technologies

Technology Comparison

Method	Scrubber	PSA	Membrane
CH_4 concentration	95% +	95% +	95% +
CH_4 recovery	95-98%	90-99%	>95%
Moisture Processing	After Separation	Before Separation	Before Separation
Secondary pollution and waste	High	High	Low
H_2S co-removal	Possible	Not possible	Possible
H_2O vapor co-removal	Not possible	Partially possible	Possible
N_2 and O_2 co-removal	Not possible	Partially possible	Partially possible

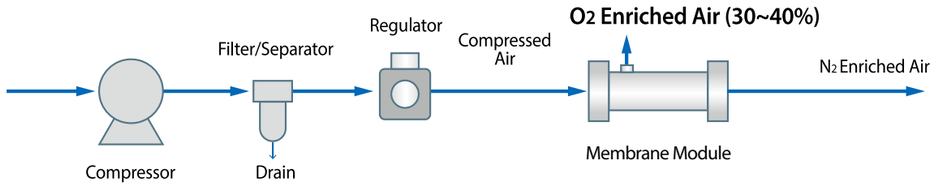






Meritair® Oxygen Generation Membrane

Schematic Diagram



Although various industrial fields require high concentration of oxygen, there are also industrial fields where only an appropriate concentration of oxygen is sufficient without the risk and cost investment required to operate a high concentration oxygen device. Oxygen generating membrane can be installed directly in medical facilities, air conditioning facilities, and sites requiring oxygen supply facilities that have these requirements, and can be an alternative to high-pressure oxygen cylinders, and also helps to improve indoor air quality.

Key Applications



Fuel Efficiency Enhancement
Oxyfuel Combustion



Healthcare



Clinical Oxygen Supply



Oxygen Chamber



Portable
Oxygen Generator



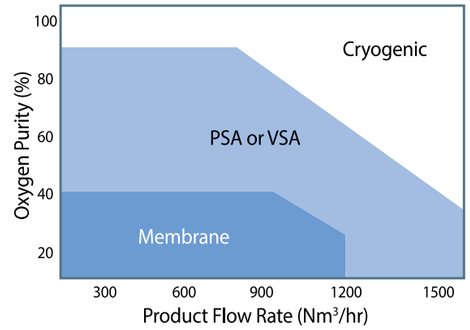
Oxygen Dissolved Water
for Fish Farm

AIRRANE Product Specifications

Model Number	Dimension (mm)			Connection (inch)			Weight
	L	OD	ID	Feed	Retentate	Permeate	
MNHO-1512A	359	55	50	3/8"	3/8"	1/4"	0.9kg
MNHO-2022A	589	70	60	3/8"	3/8"	3/8"	1.9kg
MNHO-3032A	856	110	85	1/2"	1/2"	1/2"	6.0kg
MNHO-4040A	1064	150	114	1"	1"	1"	14kg
MNHO-6160A	1580	200	157.5	1.5"	1.5"	1.5"	26kg

Why Membrane for Oxygen?

- Easy installation with low set-up costs
- Quick start-up: oxygen-enriched air is immediately provided upon start-up of the separator without any delay
- Flexible application makes it an effective solution for a wide range of facilities from small oxygen generators to large boiler system
- Easy operation and Minimal maintenance requirements
- Portable equipment for oxygen generation



Technology Comparison

Method	Cryogenic	PSA	Membrane
Oxygen Concentration	Over 99.9%	80 - 90%	30 - 40%
Installation Costs	High	High	Low
Installation Area	Large	Large	Small
Structural Features	High pressure process Need Evaporator	Batch Type Swing Process Absorbent powder residue	Simple Structure Bacteria-Free, Dust-Free
Device Size	Large	Small - Large	Small - Middle
Components	Tower / Tank /High pressure Compressor/ Refrigerator	Tower/Tank/Filter Absorbent/Swing valve/ Silencer	Separation Membrane / Filter

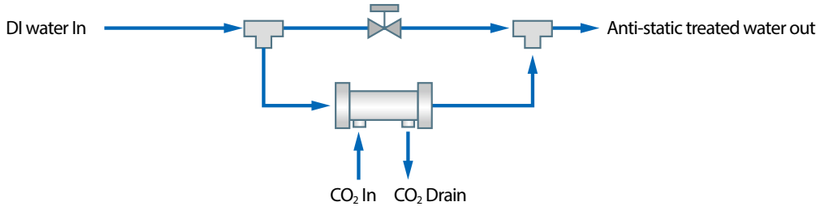






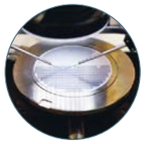
Meritair® CO_2 Injection & Bubbler

Schematic Diagram



Semi-conductor and Display industry require significant amount of deionized water for cleaning process. Dissolved CO_2 in the deionized water reduces electric resistance of the surface of wafers and display glasses, which is necessary to reduce the defect rate of the production line. Airrane provides both CO_2 injection membrane module and CO_2 bubbler device as well.

Key Applications



Ultrapure water for semi-conductor wafer cleaning process
(Scrubber, Lithography, Mask, CMP, Dicing)



Ultrapure water for display glass cleaning process
(Mask, Glass Cleaning)



Applications for anti-static treated water required

AIRRANE Product Specifications

Model Number	Dimension (mm)			Connection (inch)			DI Water
	L	OD	ID	Feed	Retentate	CO_2 In / Out	
MDB-1607P	228	64	50	1/2”	1/2”	1/8”	2.0~15Lm
MDB-2108P	274	76	66	1”	1”	1/4”	15~30L/m

Why membrane for CO_2 injection and bubbler?

- Airrane is a patent-protected membrane manufacturer
- Fast CO_2 dissolution time
- Simple design reduces maintenance requirements
- Real time data transfer system provides user’s convenience

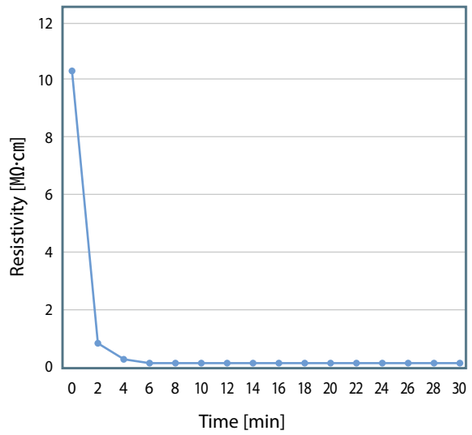
CO_2 Injection Membrane / CO_2 Bubbler

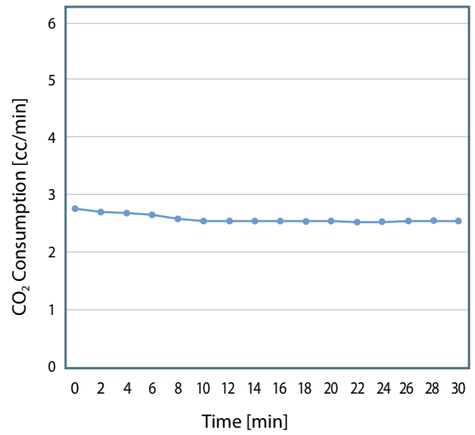
CO_2 Injection Membrane
(MDB-2108P)



CO_2 Bubbler

Performance Diagram

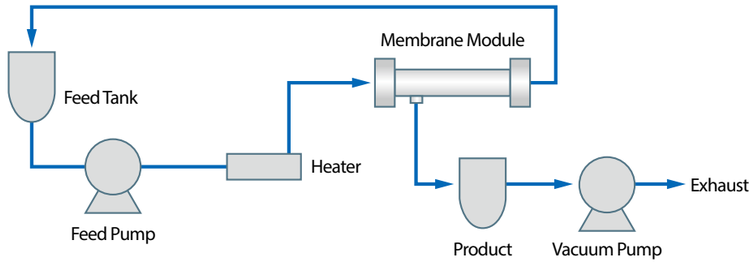




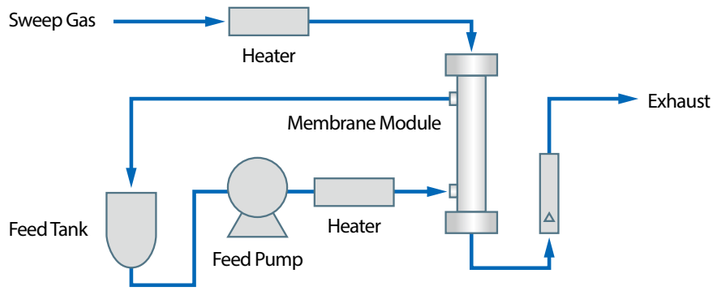
Meritair® Pervaporation & Vapor Permeation Memebrane

Schematic Diagram

Vacuum method



Sweeping method



Pervaporation is derived from the two steps of the process, permeation through the non-porous membrane by the permeate, then its evaporation into the vapor phase which is condensed into liquid phase. Membrane acts as a selective barrier between the two phases, the liquid-phase feed and the vapor-phase permeate. It allows the desired component of the liquid feed to transfer through it by vaporization. Pervaporation technology could be applied to the separation of alcohol/water mixture, organic compound/water mixture and vapor permeation process. AIRRANE is currently providing O&M service by installing IPA recycling failures within the semiconductor plant site. IPA recycling can reduce wastewater and reuse IPA (isopropyl alcohol) in the semiconductor industry.

Key Applications



Pervaporation/Vapor Permeation

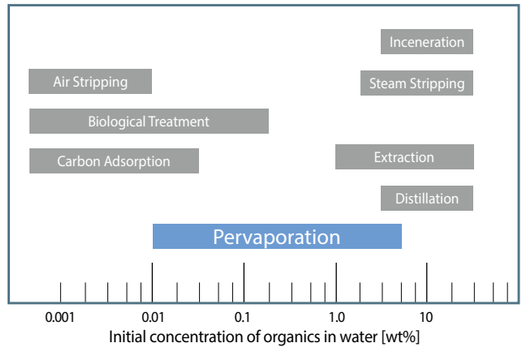
- Dehydration of water/organic liquid mixture
- Purification of water/alcohol mixture
- Removal of VOCs from water/organic liquid mixture
- Separation of organic/organic liquid mixture
- Monomer recovery from polymerization process
- Process yield and efficiency increase for dehydration of condensation reactions

AIRRANE Product Specifications

Model Number	Dimension (mm)			Connection (inch)			Weight
	L	OD	ID	Feed	Retentate	Permeate	
MVB-6040P	1080	196	150	1.5"	1.5"	1.0"	19kg

Why Membrane Pervaporation/ Vapor Permeation?

- Low-cost separation without chemical additives
- Separation of azeotrope mixtures
- Effective separation even with small gap of boiling points of mixture
- The feed mixtures to be treated may be supplied in liquid (PV) or vapor form (VP)
- Low energy consumption system for vapor permeation
- Compact size facility design
- Easy and quick start-up system
- High purity permeates attainable



Comparison of the separation methods for VOCs removal from water

Technology Comparison of dehydration costs for Ethanol from 94 vol% to 99.9 vol%

Utilities	Vapor-permeation (€/t)	Pervaporation (€/t)	Entrainer distillation (€/t)	Molecular Sieves Adsorption (€/t)
Vapor	-	6.4	60.0	40.0
Electricity	20.0	8.8	4.0	2.6
Cooling water	2.0	2.0	7.5	5.0
Replacement of membranes	9.5	15.3	-	-
Entrainer	-	-	4.8	-
Replacement of molecular sieves	-	-	-	25.0
Total costs	31.5	32.5	76.3	72.6

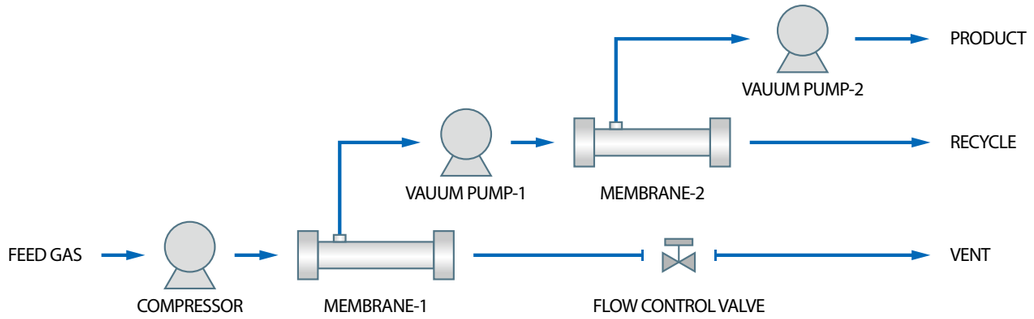
W. Kujawaski, Polish Journal of Environmemtal Studies, Vol 9, No 1(2000)





Meritair® CCUS & Clean H_2

Schematic Diagram



In order to prevent global climate change, technologies to reduce greenhouse gas emission is widely studied in the world. Airrane has been conducting research and development for many years to commercialize a membrane technology for CO_2 captures from flue gas emitted through stacks of various industries. As a result, Airrane commenced a project to supply a CO_2 separation membrane system to a commercial facility that collects 200,000 tons of CO_2 per year from a petrochemical plant flue gas. Based on this experience, we are expanding CO_2 capture business to power plants, steel mills, hydrogen production facilities and fuel cell power stations. The captured CO_2 through this process is liquefied and supplied to fresh food distributors, home shopping companies, and shipbuilders.

Top CO_2 Disposal Industries


Fossil fuel power plant


Steel industry


Cement industry


Petrochemical industry

Advantages of Membrane CCUS Technology

The CO_2 capture technologies are largely categorized in water-lean solvent method using liquid absorbent like amine or ammonia and membrane separation method. Each technology has advantages and disadvantages depending on the conditions of CO_2 emitting source. Membrane method is generally considered for higher CO_2 concentration source, while amine method is applied to lower CO_2 concentration. In reality, most of CCUS candidate locations need a retrofit designing because of the limited space to install. Membrane CCUS facility requires only 1/6 of the area compared to amine CCUS facility. On top of it, membrane is advantageous for resident acceptance and regulations like REACH.


Korea District Heating Corp.

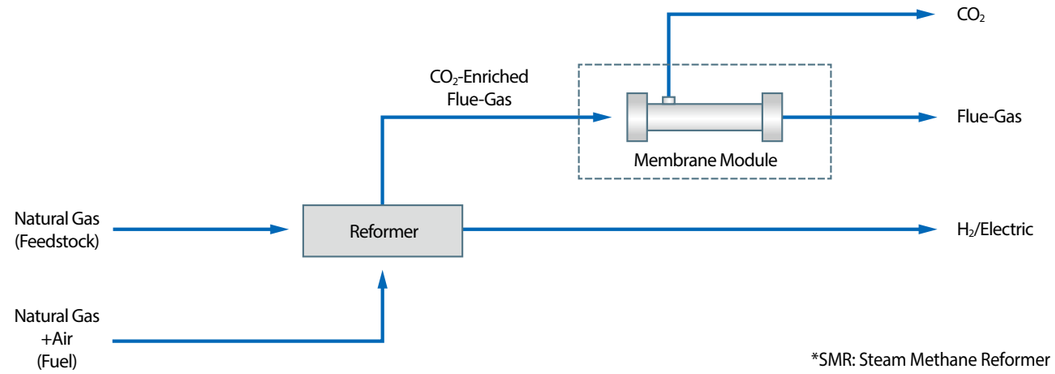


Lotte Chemical

Membrane CCUS Demonstration Cases

Item		Coal Power Plant Flue gas	LNG Power Plant Flue gas	Cement Kiln Flue gas	NCC Flue gas
Site		Daejeon	Pangyo, Suseo	Okgye	Yeosu
Membrane Process Design		2stage	3stage	3stage	3stage
Feed	Feed gas amount	110m^3/hr	400m^3/hr	2,000m^3/hr	300m^3/hr
	CO_2 Conc.	13.6~15%	4.5~8%	15~22.6%	13~14%
	O_2 Conc.	0.7~3.4%	5.5~12.8%	9.9~14.3%	4~5%
	NOx	-	-	45~54ppm	~ 50ppm
	DUST	15~22mg/m^3	~2mg/m^3	serious	< 1mg/m^3
Product	CO_2 Conc.	83.9~84.2%	65~84.9%	85.4~90.4%	90~95%
	CO_2 recovery(%)	84~86.5%	69~82%	71~92%	80%

Schematic Diagram of CO_2 Capture for SMR/H_2 Fuel Cell System



*SMR: Steam Methane Reformer