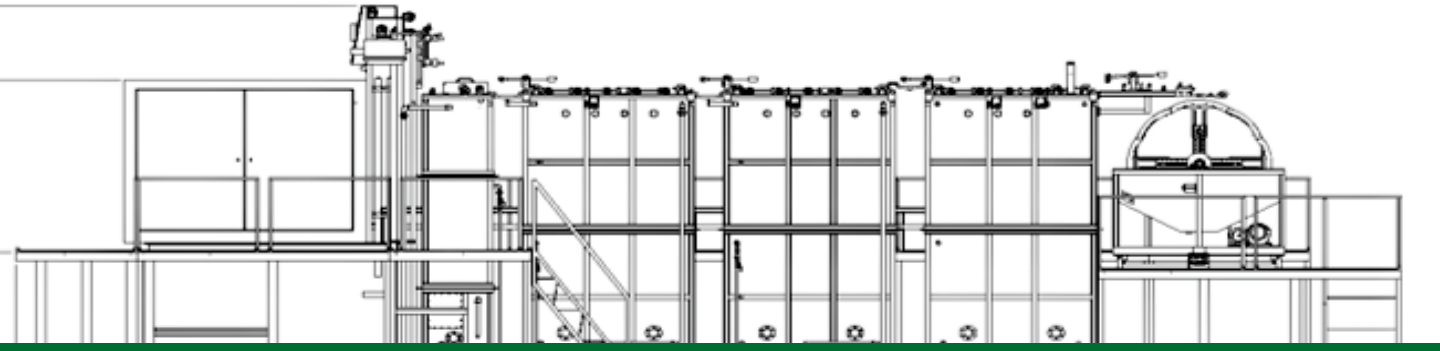
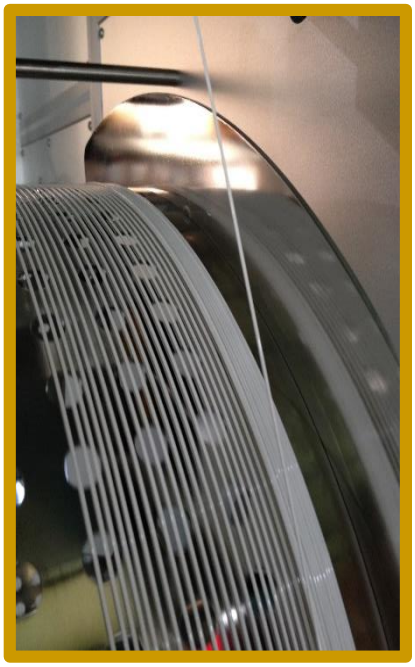


Hollow fiber membrane manufacturing systems

About MEMS

MEMS is a spinoff brand from PHILOS; a prominent firm with 20+ years' expertise in membrane production and system design. It is renowned for its capabilities in delivering comprehensive solutions for various kinds of membrane applications. MEMS meanwhile, is now managed by PHILOS's sister firm Wellspring Expand.

MEMS focuses on adopting to customer's mind of work. We have developed our systems which are user friendly and convenient to use. With years of knowledge and experience behind us we are able to offer you the most advanced design and technology in membrane evaluation and manufacturing system. No matter the size, scale, usage or application, all of our customers will benefit from our experts' advice.



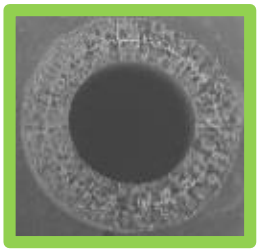
MEMS

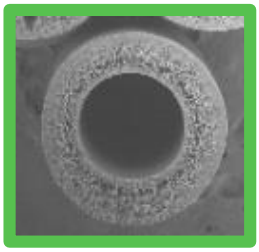
MEMS proposal to customers

We have a long history of membrane research, manufacture, and engineering, and we know exactly what goes on in the lab. We have a greater understanding of the difficulties you face as researchers than anybody else, and we're here to help. While working with researchers, we have studied each of them attentively and attempted to comprehend the psychology of researchers. When doing research, we know that ease of use is the most important factor.

We have witnessed that, despite possessing pricey and properly functioning equipment, many researchers nonetheless employ poorly constructed equipment just because they are more comfortable to use. Most of the times, the pricier the system the more complicated it is and the more room it takes in the lab, while needing a lot of cleaning, and are not even suitable for acquiring desired results. As a result, we at MEMS have made it our duty to supply researchers and developers of membranes with the most user-friendly and convenient equipment. In order to overcome even the smallest obstacles, MEMS was established. So, at MEMS, we offer "A device that understands the researcher's mind" by adapting to the user mind of researchers via our years of expertise, observation, and realization. That's what we'd want to put forward to the community of researchers.

Special feature of MEMS Hollow fiber membrane manufacturing systems





Recognizing the user's mind of research, we at MEMS offer the most precise, user-friendly, time and space efficient hollow fiber membrane manufacturing system. MEMS hollow fiber membrane manufacturing equipment allows researchers to not only prepare a lot of membrane samples in a short time with confidence in reproducibility and accuracy but can also permits to carry out experiments in various conditions.

MEMS makes the experiment easy as it solves one of the most concerned issue of researchers; Cleaning. Especially considering the challenges of cleaning the dope tank, we have designed MEMS hollow fiber spinning system is such a way that researchers no more have to worry about cleaning. We have adopted the use of disposable plastic bottles in the dope tank which can be changed every time a user wishes to work with new ingredient. This simple yet important and innovative design can save user much time and energy by making the whole experimenting experience more likeable.

Moreover, with MEMS users can now put them self at ease and not worry much about that little extra space they might need in their lab to adjust a new equipment. MEMS's compact designs make it more adjustable to fit even in the smallest of space as it has been constantly working with experts and design engineers to make the system more compact, skilled & precise.

Researchers will certainly benefit with reliable and accurate results from MEMS hollow fiber manufacturing machine as it is equipped with various sizes of spinnerets, gear pumps, inverter control, and other control systems with the highest precision allowing researchers a great precision control for the overall process from start to finish; spinning to winding. Perhaps this might even help the researcher collect more data.

In addition to obtain good and reproducible result, our experts suggest a separate water bath to be installed in the device which will completely remove solvents and additives from the membrane. As without this process, it is never possible to create a membrane with good performance and no reproducibility can be obtained.

MEMS will help you to get more reliable and diverse data.

The process of hollow fiber membrane manufacturing

MEMS supplies all sorts of facilities associated with the membrane manufacturing from the materials used to the technical facilities, it provides an overall solution to membrane manufacturing. Even the facilities to manufacture modules, and to evaluate them are available at MEMS. Including very simple experimental devices to production facilities, MEMS has it all.

Dope formulation ⇒ Hollow fiber membrane spinning ⇒ Rinsing & drying ⇒ Module potting ⇒ Module cutting ⇒ QC/Performance evaluation

For more inquiries on business of PHILOS, please refer to **www.pmems.co.kr**.

MEMS Hollow fiber membrane spinning systems

Item	System	Specification
HSL	**Lab HFM Spinning System**	Dope tank(1L) and supply by gear pump Non-temperature control system, Customer can connect wat er bath for the temperature control Free roll-guide, Winding speed is 5-30 m/min 900L x 500W x 1300H
HSR	**Lab HFM Spinning System-Re gular**	Dope tank(1L) and supply by gear pump Temperature control available for storage tanks and coagulati on bath (with circulation pump) Dope gear and winding speed control Touch scree control and data logging (7”) 900L x 700W x 1,800H
HSH	**High Functional HFM Spinning System for single layer membrane**	Dope and inner coagulant tank; 2L Dope temperature control: RT ~ 70±5℃ Motor driven roll-guide Xyz adjust of nozzle Temperature control for coagulation bath (RT~70℃) Detachable wheel, Winding speed is max. 30 m/min 2 Membrane wheel flushing bath for solvent removal 1800L x 800W x 1,800H
HSD	**HFM Spinning System for Double-layer Membrane**	Double-layered membrane spinning Dope and inner coagulant tank; 2L Dope temperature control: RT ~ 70±5℃ Motor driven roll-guide Xyz adjust of nozzle Temperature control for coagulation bath (RT~70℃) Detachable wheel, Winding speed is max. 30 m/min 2 Membrane wheel flushing bath for solvent removal 1800L x 800W x 1,800H
HSH-P	**HFM Pilot Spinning System for Single layer m embrane**	2 Hole Pilot Scale Spinning System for Single layer membra ne All the systems are temperature controlled Gear pumps are used for dope and inner coagulant supply Godet roll Traverse guide for winding system
HSD-P	**HFM Pilot Spinning System for Double- layer membrane**	2 Hole Pilot Scale Spinning System for Double layer membra ne All the systems are temperature controlled Gear pumps are used for dope and inner coagulant supply Godet roll Traverse guide for winding system

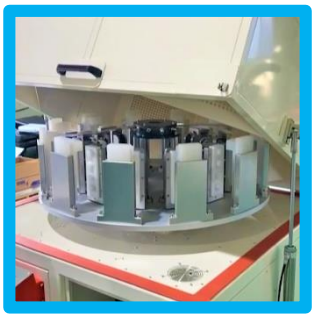
MEMS

Module potting systems

Manufactured hollow fiber membrane is inserted into the module housing and then is put into the centrifugal potting system, after the placement of the housing modules inside the system an adhesive glue is then injected into the module housing and is allowed to rotate.

An additional glue diffuser is hence strongly recommended as it helps precise mixing of PU or Epoxy adhesive whilst removing air bubbles from it, and injecting the adhesive into the module housing at precise temperatures. All these steps are all very critical and needed to module manufacturing process.

Item	System	Specification
MPL	**Lab Module Potting System**	1~3inch x 300mmL, 600L x 600W x 1,000H mm Speed control 0~350 rpm Hot air circulation, RT~ 50℃
MPP (700)	**Pilot Module Potting System-700**	2~4inch x 700mmL, 1,050L x 1,050W x 1,200H mm Speed control 0~350 rpm Hot air circulation, RT~ 50℃
MPP (1000)	**Pilot Module Potting System-1000**	2~6inch x 1,000mmL, 1,500L x 1,500W x 1,200H mm Speed control 0~350 rpm Hot air circulation, RT~ 50℃
MPC	**Commercial Module Potting System**	6~10inch x 2,000mmL, 3,000L x 3,200W x 3,200H Speed control 0~300 rpm Hot air circulation, RT~ 50℃
MPW	**Water Purifier Module Potting System**	Order-made system, 32mmD x 100mmL 24~48 ea potting/cycle 1,200L x 1,200W x 1,400H Hot air circulation, RT~ 50℃



Module cutting systems

The cutting system is essential for membrane development as it is the final and most important step of the process. Glued modules are cut at both ends and the final product is ready.

Item	System	Specification
MCL	**Lab Module Cutting System**	Max. 2 inch D x Max.20inch L 500L x 250W x 400H Guillotine, manual cutting
MCP	**Pilot Module Cutting System**	Max 4 inch D x Max.40inch L 1,500L x 800W x 1800H Guillotine, automatic cutting PLC control
MCC	**Commercial Module Cutting System**	6~10inch D x Max.80inch L 2,500L x 1,000W x 2,300H Guillotine, hydraulic power moving AC Servo system, LM guide
MCW	**Water purifier Module Cutting System**	2~3inch x 160mmL, 1,000L x 1,000W x 2,000H Automatic cutting

New area of hollow fiber membranes

Coating systems for Gas, RO, FO, PRO and other composite membranes

Item	System	Specification
HCS	**Hollow fiber membrane solution coating system**	Winding & unwinding and tension control Dip coating and drying system 1~10 m/min by inverter control and traverse winding Temperature control RT ~ 120℃ by air blower 1,800L x 1,000W x 2,000H
HCP	**Hollow fiber membrane TFC coating system by polymerization**	Three Chemical treatment process (Amine-Acyl Chloride-post c hemical treat) 0.4~2 m/min by inverter control and traverse winding Godet roll, insulating, N2 gas purge, Temp. control : 10,500L x 4,000W x 2,000H
HCM	**Hollow fiber membrane coating system as a module**	Two chemical treatment of membrane module as it is. Max. 10L/min flow of chemicals Modules are set in the oven, temperature controlled : 1,800 L x 840W x 1,720H

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