08

중공사막 내/외부
연속 코팅 기술

연구책임자
신재생에너지연구소
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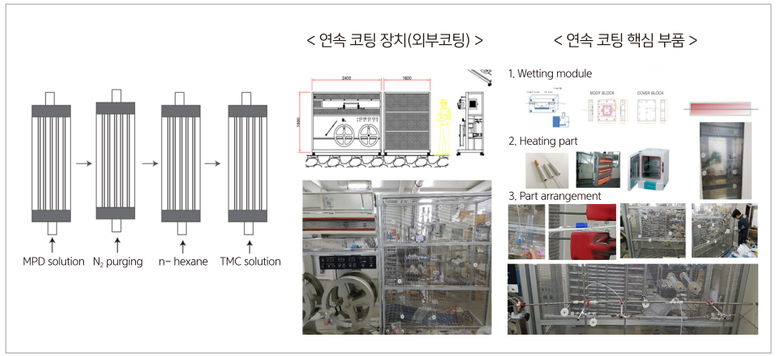
박철호

집적도에 용이한 중공사막에 기능성 나노 코팅 기술, 모듈내부 순환식 연속 코팅 기술, 연속식 중공사막 외부 코팅 기술.

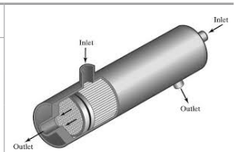
기술의 구성도/개념도



기술의 주요 내용 및 특징

- 소수성, 친수성등 중공사막 내/외부 나노박막 코팅 기술
- 박막 코팅 소재는 계면중합을 통한 fully cross-linked polyamide계
- 단일 고분자 및 무기물 소재 코팅

기술의 적용처

응용분야	적용제품	
수처리 막 (RO, NF, FO, PRO등) / Gas separation 분야	경수연화, 해수담수화, 폐수처리 등 RO 및 NF분야 분리막 시장 / CO_2, SO_2, H_2O, IPA등 기체분리막 시장	

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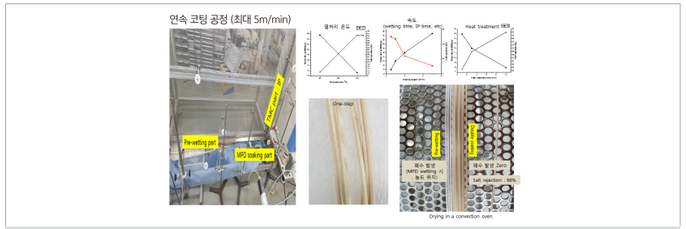
기술의 비교우위성/기존 기술 대비 차별성

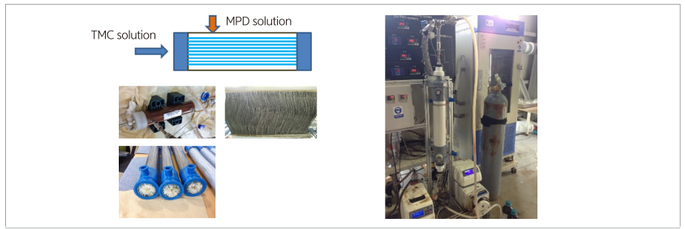
기존 기술	본 기술
◦ 중공사막 내부코팅 시 코팅 용액 불균일 발생 (e.g., 4인치 1200가닥) ◦ 연속식 외부 계면중합 기술 없음	◦ (내부코팅) 내/외부 압력을 일정하게 유지하여 모든 막에서 균일하게 코팅 ◦ (외부코팅) 연속으로 계면중합기술 적용 가능

실험 및 실증 데이터



외부코팅

››› **(외부코팅)** 연속식 계면중합을 통해 PVDF 다공성 막에 poly(piperazine-amide) 나노막 코팅



내부코팅

››› **(내부코팅)** co-flowing 방식을 통한 연속식 계면중합을 통해 PVDF, PSf, PES등 다공성 막에 poly(piperazine-amide), aromatic polyamide 나노막 코팅

기술의 성숙도

[TRL 6: 파일롯 규모 시작품 제작 및 성능 평가]
~ [TRL 7: 신뢰성평가 및 수요기업 평가]

지식재산권 현황

순번	발명의 명칭	출원번호	출원일자	등록번호	등록일자
1	압력지연삼투용 복합분리막의 제조방법	10-2015-0160703	2015.11.16	10-1729183	2017.04.17
2	계면중합을 이용한 중공사막의 코팅방법	10-2017-0139972	2017.10.26	-	-
3	소수성 다공지지체 표면에 무결점 초나노 박막 코팅 제조 방법	10-2017-0017003	2017.02.07	-	-

08

Continuous Coating Technology for the Inside and Outside of Hollow Fiber Membranes

Functional nanocoating technology for hollow fiber membranes suitable for high integration applications; in-module circulating-type interfacial polymerization technology; and continuous interfacial polymerization technology for the outside of hollow fiber membranes.

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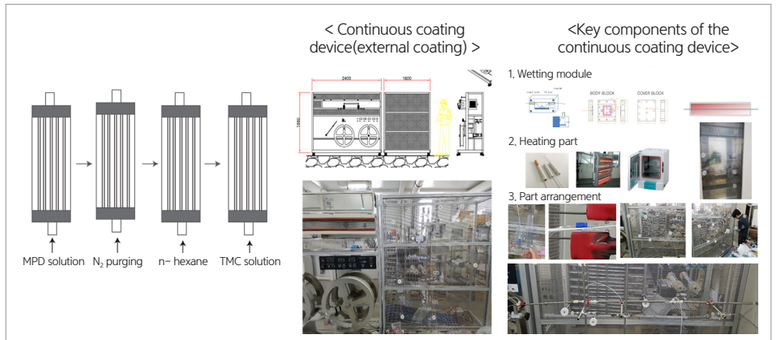
Structural Diagram/Conceptual Diagram

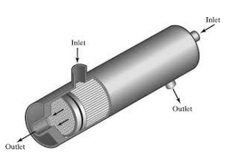


Description and Characteristics of Technology

- Interfacial polymerization technology and system at the inside/outside of hollow fiber membranes for large-scale modules
- Autolyzed systems
- Minimized usage
- Possible for any type of polymers, e.g., PS, PES, PEEK, PVDF, PE, PP, etc.

Scope of Application

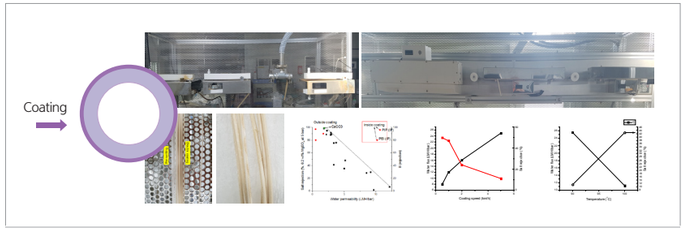
Application Fields	Products	
Water-treatment membranes (RO, NF, FO, PRO, etc.) / Gas separation fields	Water softening, seawater desalination, wastewater treatment, etc. RO and NF-related separation membrane market / CO_2, SO_2, H_2O, IPA, etc. Gas separation membrane market	



Comparative advantages of technology / Differentiation from existing technologies

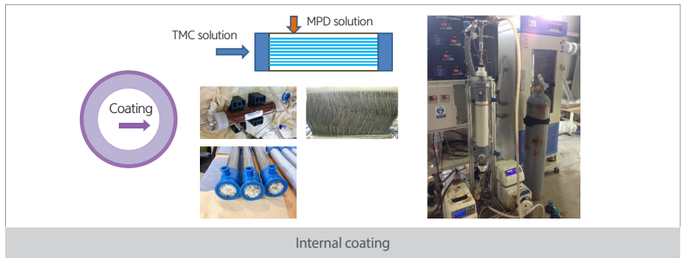
Conventional Technology	Present Technology
◦ A coating solution becomes non-uniform when applied to the inside of hollow fiber membranes (e.g., 4 inches, 1200 strings) ◦ Continuous external interfacial polymerization technology not available	◦ **(Internal coating)** All membranes are uniformly coated because the internal/external pressures are maintained at constant levels. ◦ **(External coating)** Continuous external interfacial polymerization technology available

Experimental and empirical data



External coating

››› **(External coating)** Continuous external interfacial polymerization on hollow fiber membranes



Internal coating

››› **(Internal coating)** Continuous internal interfacial polymerization in hollow fiber membranes

Maturity level of technology

1 2 3 4 5 **6** **7** 8 9

Basic Research | Experiment | Prototype | Turning into practice | Commercialization

[TRL 6: Manufacturing and performance evaluation of pilot-scale prototypes] ~ [TRL 7: Evaluation of reliability and companies in demand]

Current status of intellectual property rights

No.	Title of Invention	Application Number	Application Date	Registration Number	Registration Date
1	Thin-film composite membrane for pressure-retarded osmosis	10-2015-0160703	2015.11.16	10-1729183	2017.04.17
2	Method for coating hollow fiber membranes using interfacial polymerization	10-2017-0139972	2017.10.26	-	-
3	Manufacturing method of defect-free ultra-nano thin film coating on the hydrophobic porous support surface	10-2017-0017003	2017.02.07	-	-