TECH OFFER

Nature-Inspired Superhydrophobic Membranes for Membrane Distillation

KEY INFORMATION

TECHNOLOGY CATEGORY:
Environment, Clean Air & Water - Filter Membrane & Absorption Material

TECHNOLOGY READINESS LEVEL (TRL): **TRL4**
COUNTRY: **SINGAPORE**
ID NUMBER: **TO174924**

OVERVIEW

Current state-of-the-art lab-scale methods for fabricating superhydrophobic membranes for membrane distillation often involve complex surface modifications or the use of nanomaterials. However, these methods are difficult to scale up.

This technology relates to a pure rheological spray-assisted non-solvent induced phase separation (SANIPS) approach to fabricate superhydrophobic polyvinylidene fluoride (PVDF) membranes. The resulting membranes have high porosity, superhydrophobicity, high liquid entry pressure, and hierarchical micro/nanostructures. They can also be easily scaled up.

The spraying step caused local distortion of the membrane surface, which induced a two-stage phase inversion. This led to the formation of multilevel polymeric crystal structures. The morphological structures and other membrane properties (e.g., mechanical strength and liquid entry pressure) could be tuned by applying spraying materials with different physicochemical properties.

This facile fabrication method will pave the way for the large-scale production of superhydrophobic membranes for membrane

distillation.

TECHNOLOGY FEATURES & SPECIFICATIONS

Flat sheet membrane:

- Fabricated from commercial PVDF polymer.
- Superhydrophobic.
- High liquid entry pressure.
- One-step fabrication of the membrane with online modification of the membrane surface.

Modules:

- Industrial-scale modules available.
- Customized modular design.
- Spiral-wound modules.

POTENTIAL APPLICATIONS

- Treatment of high salinity waters from mining, metal treatment, pharmaceutical, chemical synthesis, and oil and gas operations.
- Achieve zero-liquid discharge (ZLD) in industrial processes.
- Desalination of seawater or brackish water.
- Treat brine that is produced as a byproduct of desalination.

MARKET TRENDS & OPPORTUNITIES

Membrane distillation (MD) is a membrane technology that uses the vapor pressure gradient across a porous hydrophobic membrane to separate water from other components.

MD offers several advantages over other membrane separation processes, including:

- Lower operating pressures
- Insensitivity to feed concentration for seawater desalination
- Almost 100% rejection of solutes
- Relatively low operating temperatures

These advantages have led to promising results in MD processes for zero-liquid discharge, desalination, desalination brine treatment, and many other wastewater treatment applications.

However, the commercialization of MD has been constrained by the lack of commercially available high-performance MD membranes and high energy consumption.

This work addresses the lack of commercially available high-performance MD membranes and has the potential to be the next workhorse of the water industry.

UNIQUE VALUE PROPOSITION

- Treatment of difficult streams which is not possible with other conventional methods
- Usage of waste heat
- High surface area to volume ratio compared to the plate and frame membrane distillation as the current work is in the spiral-wound configuration
- Proven method of translating membrane fabrication from lab-scale to industrial-scale phase inversion (PI) casting line
- Readily available industrial-scale process settings to fabricate membrane of one meter in width and several hundreds of meter in length.