

TECH OFFER

Low Temperature Membrane-Pervaporation System for High Value Product Concentration



KEY INFORMATION

TECHNOLOGY CATEGORY:

Sustainability - Low Carbon Economy

Foods - Ingredients

Manufacturing - Chemical Processes

TECHNOLOGY READINESS LEVEL (TRL): **TRL3**

COUNTRY: **SINGAPORE**

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OVERVIEW

A challenge faced by many chemical processing plants is the high process temperature and high energy consumption. For example, in the Traditional Chinese Medicine (TCM) production process, one of the commonly used approaches of concentrating the medicine is by evaporation. This process operates at 100°C and aims to remove 2/3 of the total amount of water from the feed solution. The main issues are:

- High operating temperature causing irreversible damage to the active ingredients.
- Taking up 75% of the overall energy consumed.
- 2-3 days to process one batch of the extracted liquid.
- Labour-intensive and hard to scale up. Furthermore, as the production is operated in batch mode, the boiler needs to be turned off and on (heating and cooling) frequently.

To overcome these challenges, the membrane – pervaporation system has been developed. The operating principles have been tested at laboratory scale using actual TCM products. The operating temperature can be lowered so that the risk of damage to the active ingredients is reduced. It was computed that an energy saving of 39% can be achieved. The team that designed and developed the system is well-versed with membrane technology and is ready to transfer the know-how and knowledge. They are seeking partners to collaborate and further develop this proof-of-concept for commercial deployment, targeting applications where thermal damage to high value active ingredients are of concern.

TECHNOLOGY FEATURES & SPECIFICATIONS

The integrated membrane – pervaporation system provides an attractive alternative for the purification and concentration of water-based extracts. The system makes use of proven technologies that are widely deployed in the industry to help reduce implementation risk and cost. It uses widely available commercial hollow fibre ultrafiltration membranes (operating at a low pressure of a few bar) from the water treatment industry to directly process the filtrate and then further concentrate the permeate using pervaporation technique which uses widely available polymeric hollow fibre membranes. With such a system, a lower operating temperature can be used on the feed solution thereby reducing energy footprint and also reducing the risk to thermal damage on the active ingredients in the permeate. The system produces water vapour from the condenser that is downstream to the pervaporate, which can be condensed into distilled water for other applications. The system's operating parameters can be customised to meet the specific requirements needed to preserve the active ingredients' functional properties and at the same time balance the overall processing time and energy consumption.

POTENTIAL APPLICATIONS

Potential applications include:

- Purification and concentration of liquid extract (e.g. TCM)
- Purification and concentration of liquid food and beverage products
- Recycling of alcohol solvent in semiconductor industry
- Separation, purification and concentration of liquid chemical products in chemical industry
- Separation, purification and concentration of intermediate and final products in pharmaceutical industry
- Water treatment and seawater desalination

UNIQUE VALUE PROPOSITION

- Operating at a lower temperature to minimise the damage to active ingredients
- The system has the potential to significantly reduce the energy consumption by 39%
- Increase purity of the end products
- It can be automated for continuous production