OPEN ACCESS Freely available online

ISSN: 2155-9589
Journal of Membrane Science & Technology

Opinion Article

Mechanism of Membrane Distillation Separation Technique

Kabeel Shama*

Department of Science and Technology, University of Tanta, Tanta, Egypt

DESCRIPTION

Membrane Distillation (MD) is a relatively recent process option to traditional separation methods like distillation and Reverse Osmosis (RO). The theoretical rejection of ions, macro molecules, colloids, cells, and other non-volatile substances, membrane distillation is superior to conventional separation processes. Additionally, because it is lower operating temperature and pressure, it is better for thermally sensitive solutions. Due to the smaller vapour area, the technique is significantly less expensive than conventional distillation. In comparison, Membrane Distillation (MD) has various limitations. The method requires an aqueous solution, which should be diluted to prevent wetting of hydrophobic membranes. This is the main constraint on the phenomena.

This prevents the use of membrane distillation to processes like concentration of ionic, colloidal, or other relatively non-volatile aqueous solutions and desalination (a field currently dominated by reverse osmosis). Downstream processing has always included membranes as a crucial component. The current review describes the state-of-the-art of the downstream processing processes of Osmotic Membrane Distillation (OMD) and Membrane Distillation (MD), with emphasis on work completed after 2008. The most important aspect of membrane distillation separation performance is membrane selection. The membrane utilized in the MD process needs to be porous and hydrophobic. Different membrane types exist that meet these requirements. The effectiveness of a particular MD application, however, it is also heavily depends on other elements like mass transfer resistance, thermal stability, thermal conductivity, wetting phenomena, and module characterization. Membrane materials, membrane modules, contact angle, liquid entry pressure, and wetting phenomena are membrane and module-related parameters that influence choosing the best membrane.

Applications of membrane distillation

Desalination and the creation of ultra-pure water from brackish and seawater are the two main uses of membrane distillation in the food industry. The main benefit of MD in desalination is its capacity to reach large rejection factors, which RO at high permeate fluxes is unable to do. With rejection rates for non-volatile chemicals of approximately 100%, the production of high purity water is well known. Waste waters from the pharmaceutical and textile industries, as well as underground fluids contaminated with heavy metals and sulphuric acid solutions, have all been effectively cleaned up by using the MD method. The lower energy usage of MD in water purification is one of its key benefits.

As previously noted, MD is also requires energy for the evaporation of water, just like any other distillation process. The MD process, on the other hand, may function efficiently at low temperatures, making it possible to use low-grade waste and/or alternative energy sources like solar and geothermal energy. For the concentration of fruit juice, membrane distillation and osmotic distillation are presented as very difficult technologies that enable the limitations of conventional thermal evaporation encountered by the application of high temperatures. By using a micro porous PVDF (Polyvinylidene Difluoride) membrane, the preliminary results of MD's study on the effective concentration of orange juice were given. In the model of orange juice, the water flux and scent retention of MD and OD are compared. With OD (Osmotic Distillation) and higher flux values, a greater retention per unit of water removed was seen. It is generally known that when used in conjunction with other membrane technologies, MD offers significant advantages over using MD alone for the concentration of different juices, particularly grape juice. Alcohol and other volatile metabolites can be successfully removed from the fermentation broth by using the MD procedure. Concentrating natural food colours, de-alcoholising wine, and concentrating plant and herbal extracts are additional uses of MD in the food industry.

CONCLUSION

Due to its reduced energy requirements compared to classical distillation, lower operating pressures, and higher rejection factors compared to pressure-driven processes like NF (Nano Filtration) and RO (Reverse Osmosis), MD has attracted significant interest as a potential replacement for other separation

Correspondence to: Kabeel Shama, Department of Science and Technology, University of Tanta, Tanta, Egypt, E-mail: Zhongde@gmail.com

Received: 01-Jun-2022, Manuscript No. JMST-22-17503; **Editor assigned:** 03-Jun-2022, Pre QC No. JMST-22-17503 (PQ); **Reviewed:** 17-Jun-2022, QC No. JMST-22-17503; **Revised:** 24-Jun-2022, Manuscript No. JMST-22-17503 (R); **Published:** 04-Jul-2022, DOI: 10.35248/2155-9589.22.12.285.

Citation: Shama K (2022) Mechanism of Membrane Distillation Separation Technique. J Membr Sci Techno. 12:285.

processes. Even though MD has been around for more than 40 years, there are a few issues when it comes to applying it in the industrial setting.

The achievement of high concentration levels in specific fruit juice samples should be thoroughly investigated, taking into account effects on mass and heat transfer processes, membrane properties, and quality factors. On the other hand, there aren't commercially available MD units; almost all membrane modules are made for microfiltration rather than MD. Novel membranes created especially for MD applications should be produced in a way that is both practical and affordable. For large-scale applications, research on Tran's membrane flux enhancement (i.e., acoustic field) is necessary. In order to increase the effectiveness of the entire system and make the procedure financially viable for industrial applications, more consideration should be given to the possibility of integrating MD with other separation techniques. Coupled operation of MD and OD has the potential for fruit juice concentration to address high temperature-related issues (i.e., fragrance and colour loss seen in MD).