CLEARBAKK

A member of the ALSYS Group

Pervaporation: A Practical Separation Process for Industrial Applications

White Paper

403.295.8054 | clearbakk@alsys-group.com | www.clearbakk.com

Pervaporation: A Practical Separation Process for Industrial Applications

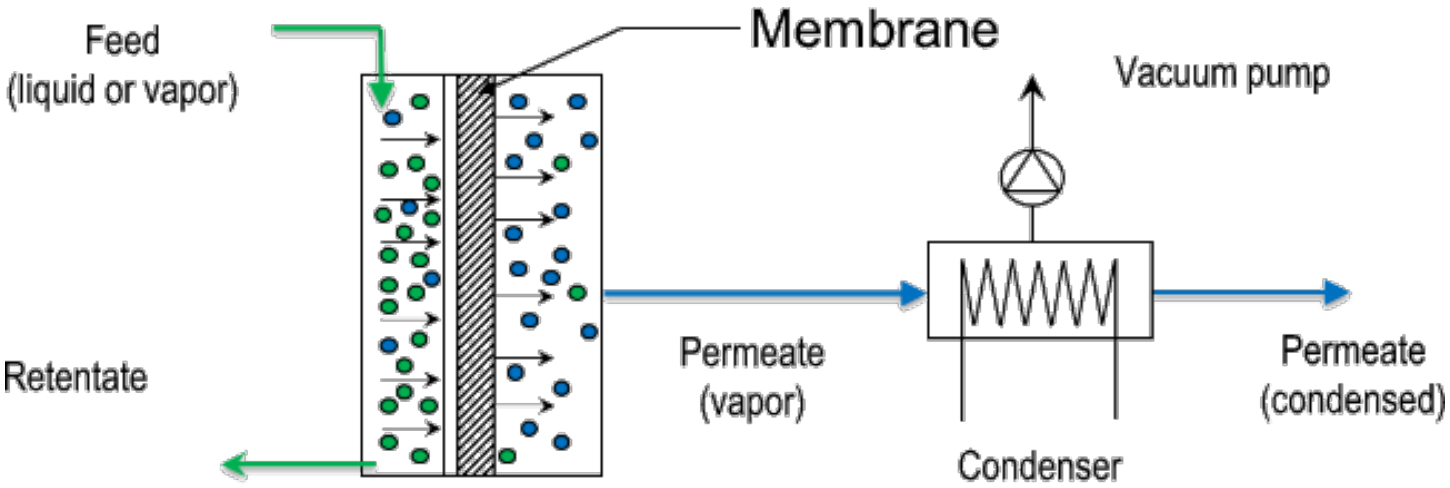
White Paper

WHAT IS THE PROBLEM?

The separation of mixtures into their different components is crucial to several industries including oil & gas, pharmaceuticals, and the food & beverage industry. Specific mixtures can be particularly difficult to separate using conventional processes, such as azeotropes for distillation where the constituents evaporate at the same rate and no separation occurs. Often, separating such mixtures can only be done with substantial difficulties, requiring chemical additives that tarnish the product or additional unit operations. In other cases, distillation cannot be used because the system is sensitive to high temperatures and the product would be compromised during the separation.

WHAT IS THE SOLUTION?

Pervaporation is a membrane-based separation technique that, rather than being driven by high pressure differences like reverse osmosis or completely driven thermally like distillation, leverages selective permeation and vaporization to evaporate one component of a liquid mixture. The membrane selectively absorbs the targeted component and transports it across the membrane by localized diffusion where it is then desorbed as a vapor and condensed.



CLEARBAKK
A member of the ALSYS Group

403.295.8054
clearbakk@alsys-group.com
www.clearbakk.com

Pervaporation: A Practical Separation Process for Industrial Applications

White Paper

Even though the concept of selective permeation has been known for some time, pervaporation is a relatively modern technology and has made significant progress over the past decades. It has matured largely by optimizing the membrane material and by integrating pervaporation units into existing separation technologies such as distillation. One such advancement has been the development of hydrophilic membranes, which allow for the targeted and efficient removal of water from otherwise challenging mixtures.

As water plays such a pivotal role in many industries, pervaporation has the potential to redefine what is possible and challenge more mature processes. Pervaporation has practical applications in dehydration, purification, and water treatment to improve energy savings, reduce the plant footprint, and provide solutions where none existed.

DEHYDRATION OF BUTANOL

Feed: 95%Butanol, 5%Water

Temperature: 80°C

Flux: 3.5 kg/h.m^2

Permeate composition: 98%Water, 2%Butanol

DEHYDRATION OF ETHANOL

Feed: 90%Ethanol, 10%Water

Temperature: 75°C

Flux: 3.5 kg/h.m^2

Permeate composition: 80%Water, 20%Ethanol

DEHYDRATION OF ESTERIFICATION MIXTURE

Feed: Ester acrylate, Alcohol, Acrylic acid, 15%Water

Temperature: 75°C

Flux: 12 kg/h.m^2

Permeate composition: 90%Water, Alcohol, Acrylic acid, Ester acrylate

DEHYDRATION OF SOLVENT MIXTURE

Feed: 88% Ethanol, 5% Methyl isobutyl ketone, 7%Water

Temperature: 70°C

Average flux: 2,5 kg/h.m^2 (Dehydration from 7% to 1%water)

Permeate composition: 80%Water

CONCENTRATION OF AROMATIC MIXTURE IN WATER

Feed: Water, 30g/L Polyphenols, 50g/L Suspended solids.

Temperature: 40°C

Flux: 2,5kg/h.m^2

Permeate composition: containing traces of organic compounds.

DEHYDRATION OF SOLVENT MIXTURE

Feed: 91,7%Ethyl acetate, 3,3%Water, 2%Ethanol, 2%Toluene, 1%Acetic acid

Temperature: 70°C

Average flux: 1,5 kg/h.m^2 (Dehydration from 3,3% to 0,3%water)

Permeate composition: 87%Water

CLEARBAKK
A member of the ALSYS Group

403.295.8054
clearbakk@alsys-group.com
www.clearbakk.com

WHY ALSYS?

Alsys' membrane production and connections to integrated engineering assets not only allow us to provide the solution at the best rate but also custom tailored to your specific needs, regardless of whether the solution requires more traditional zeolite membranes or more novel and proprietary membranes such as HybSi membranes. Alsys can provide the confidence that you have the most effective solution, working with you at any stage of the solution to provide anything from proposal de-risking, offering rental units and pilot scale design, to commissioning, and maintenance assistance.

403.295.8054
clearbakk@alsys-group.com
www.clearbakk.com