

# PERVAPORATION PILOT PLANT

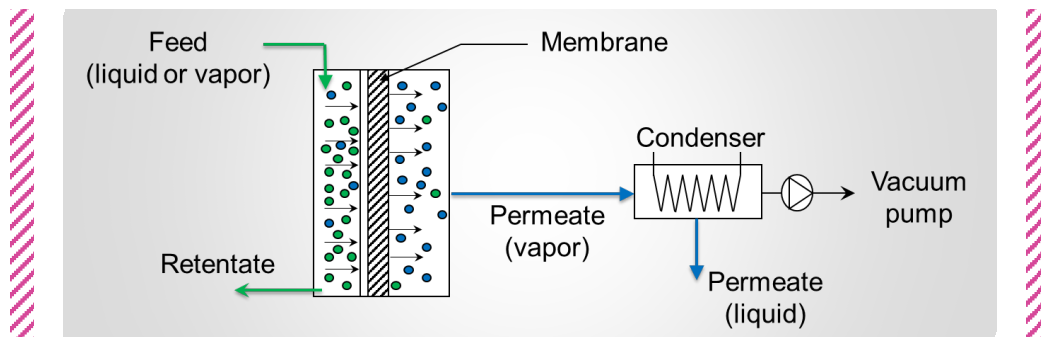
## Data sheet

### Innovating for the sustainability and reliability of industrial processes

Pervaporation is a process for the separation of liquid mixtures by partial vaporisation. ORELIS Environnement has access to the Hybsi® technology of ceramic pervaporation membranes which allows water to be separated from solvents and organic compounds. ORELIS Environnement also has a mobile system on a pilot scale (feasibility studies, process design) and experience in the areas of

solvent recycling by dehydration (Pharmaceutical), the concentration of aromatic mixtures (Fine chemistry) and the improvement of esterification processes by selectively eliminating water from the reaction mixtures (Chemicals).

### Principle of pervaporation



### ALSYS experiences in the field of pervaporation technology

| Industries   | Applications  | Benefits   |
|--|---|--|
| <ul style="list-style-type: none"> <li>Pharmaceutical</li> </ul>   | <ul style="list-style-type: none"> <li>Solvent mixtures recycling by dehydration</li> </ul>   | <ul style="list-style-type: none"> <li>High selectivity</li> <li>Low energy consumption</li> </ul>   |
| <ul style="list-style-type: none"> <li>Chemicals</li> <li>Petrochemicals</li> <li>Biofuels</li> </ul>                          | <ul style="list-style-type: none"> <li>Alcohols dehydration (IPA, Butanol...)</li> <li>Esterification mixtures dehydration</li> <li>Azeotropic breaking</li> <li>Solvent recycling</li> </ul> | <ul style="list-style-type: none"> <li>Implementation with minimum process modification</li> <li>Flexible for batch or continuous processes</li> </ul> |
| <ul style="list-style-type: none"> <li>Fine chemistry</li> <li>Flavor &amp; Fragrances</li> <li>Food &amp; Beverage</li> </ul> | <ul style="list-style-type: none"> <li>Concentration of aromatic mixtures</li> </ul>  | <ul style="list-style-type: none"> <li>Process intensification</li> </ul>  |

### What makes PERVAPORATION PILOT PLANT unique?

- Compact design, small footprint, large membrane area for a small feed volume
- Easy integration into an industrial plant
- **Versatile pilot plant**
- Could work with vapor or liquid feed
- Extrapolation / Scaling-up: x 100
- Fast and complete dehydration of organic mixtures (100 ppm of water possible at the end of the purification)
- High water permeation flowrate > 4 kg/h
- Compatible with most types of solvents
- Continuous permeate condensation
- Extremely stable process conditions

#### Versatile pilot plant

- Ceramic or polymeric membrane
- Pervaporation or vapor permeation
- Dehydration at stable conditions or extremely quick purification
- Semi-automatic or automatic control



# How the PERVAPORATION PILOT PLANT works?

## (5): Monitoring

Control interface



## (2): Membrane module



1 membrane

0,15 m<sup>2</sup>

7 membranes

1,05 m<sup>2</sup>

## (1): Feed

Max Temperature

120°C

Max Pressure

8 bar



pH 2 to 14

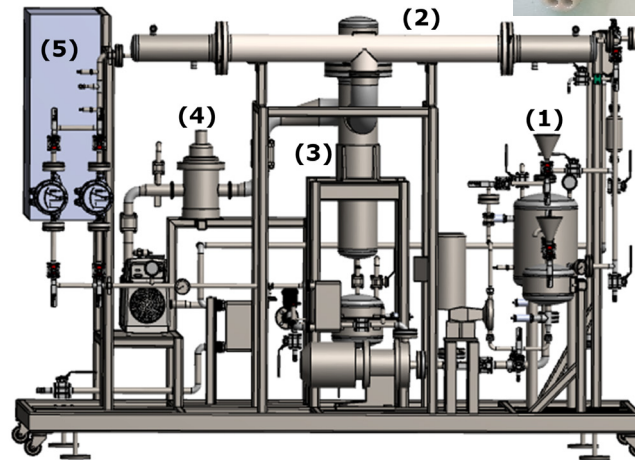
## (3) & (4): Permeate

Condenser

0 to -50°C

Cold trap

- 180°C

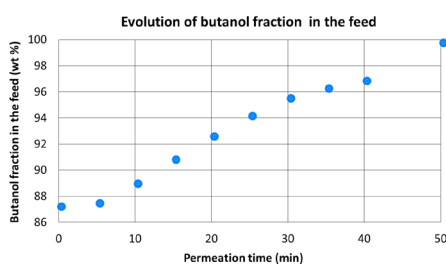


# Performances

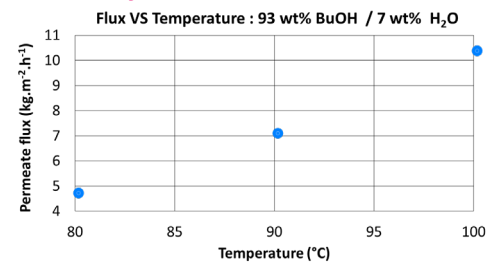
## Performances with HYBSI® ceramic membrane (hybrid silica)

| Feed composition  | Temperature (°C) | Flux (kg/h.m <sup>2</sup> ) | Permeate composition                             |
|---|------------------|-----------------------------|--|
| 95% Butanol, 5% Water   | 80               | 3,5                         | 2% Butanol, 98% Water                            |
| 90% Ethanol, 10% Water  | 75               | 3,5                         | 20% Ethanol, 80% Water                           |
| 88% Ethanol, 5% Methyl isobutyl ketone, 7% Water                    | 70               | 2,5                         | 80% Water  |
| 92% Ethyl acetate, 2% Ethanol, 2% Toluene, 1% Acetic acid, 3% Water | 70               | 1,5                         | 87% Water  |
| Ester acrylate, Alcohol, Acrylic acid, 15% Water                    | 75               | 12                          | Ester acrylate, Alcohol, Acrylic acid, 90% Water |
| Water, 30g/L Polyphenols, 50g/L Suspended solids                    | 40               | 2,5                         | Containing traces of organic compounds           |

## Butanol concentration (20L at 70°C)



## Butanol dehydration (80-100°C)



## Contacts

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