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Separation of trimethyl borate from azeotrope mixture by pervaporation

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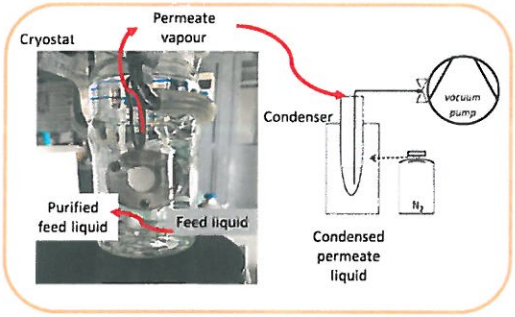
A development of a membrane system able to separate Trimethyl borate/methanol from their azeotrope mixture was proceeded. Pervaporation (PV) is membrane process able to separate different compounds of a multi-component or binary mixture and it was preferred among the other membrane processes as it is successfully used to separate liquid azeotropic mixtures, close-boiling-point mixtures, and structural isomers. A driving force of PV is gradient of chemical potential of each permeant. During the process, a faster permeating component from the mixture passes preferentially through the selective membrane and desorbs as a vapour because of the lower pressure on the back side of the membrane. Thus, the separation of mixtures of liquids is driven by difference of partial pressure of permeants, which evaporates through a non-porous membrane. The pervaporate can be collected in liquid state by condensation inside a coldtrap, which is cooled by liquid nitrogen. The pervaporation set-up is schematised in following picture:



The pervaporation is operated with low pressures 60 Pa and at 25C, which is energy-efficient. Moreover, the application of different pressures on the membrane can reduce the required membrane area and total cost of the process. The pervaporation membranes are non-porous, dense membranes, and made of polymeric materials, showing different permeabilities according to different components. The present research has tested several membranes such as:

- PVA 4155 – 80/2871
- PVA 4155-40/3052
- PDMS 4155 -30/305 R

The main conclusion of the study deals with the fact that PDMS membranes favourably removes the methanol while PVA membranes are able to transport preferentially Trimethyl borate under the same experimental conditions.