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Letter to the Editor

From Collodion Bag to Skid-Mounted Pervaporation Unit: 100th Anniversary

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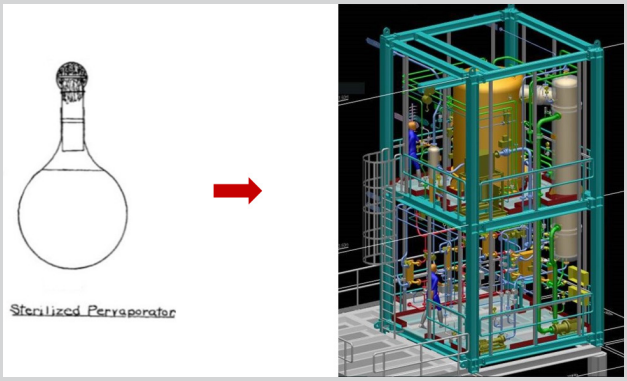
Highlights

- 100th anniversary of pervaporation
- Pervaporation, an exotic technology?
- From a bag to complete PV plants

Graphical abstract



Undoubtedly Philip Adolph Kober deserves to be remembered this year. He officially introduced the term "pervaporation" in 1917 after his assistant observed that a liquid has evaporated from a collodion bag [1]. This observation led Kober to perform laboratory trials to confirm that the vapour permeated through the collodion membrane. Pervaporation (PV) and vapour permeation (VP) are now established technologies for molecular separation, but they are still considered exotic. These unit operations are mainly applied to break azeotropes of organic/water and organic/organic mixtures, and have become an alternative separation technology for solvent dehydration and methanol removal from organics. Today, Kober's idea is elegantly embodied as skid-mounted PV and VP plants (Figure 1 [1, 2]).

PV has many advantages compared to conventional thermal separation processes. However, it is not always as familiar to end-users as for example distillation. Lack of information and knowledge on membrane and membrane technology are the reasons hindering the wider use of PV. Although PV is part of thermal separation technology lectures at universities, it could be taught in more detail including laboratory studies. Therefore, one goal should be to raise awareness of students and young engineers by training them in the laboratories.

Membrane life-time is also a subject which needs to be better understood and accepted by end users. Like catalyst deactivation in catalytic reaction processes, membranes get used up and need to be replaced at some point in time. On the one hand, the membrane life-time must certainly be improved, i.e. the next generation of pervaporation membranes must be more robust and stable to harsh chemicals than the existing ones. On the other hand, we must also focus on developing a fast and cost-effective membrane replacement to minimize plant downtime and decrease operating costs.

Since pervaporation became commercial, several new membranes have been developed and reported as promising for scaling-up and commercialization. Although, development of new membranes is very important, intensive laboratory and pilot tests related to reproducibility and stability are even more important for commercialisation. Therefore, it would be good if scientific reports include some stability tests with membranes obtained in the laboratory.

In addition to reproducibility and stability of membranes, the uniformity of performance data reported in scientific journal is also an issue. Baker et al advocated the presentation of performance data in a normalized form [3]. We should follow this advice and start to standardize the performance data too.

In the industry, thousands of mixtures are still being separated by energy intensive separation processes. So, young scientists still have room for further membrane development. So, let's commemorate the 100th anniversary of "pervaporation" by committing ourselves to position it as it deserves.

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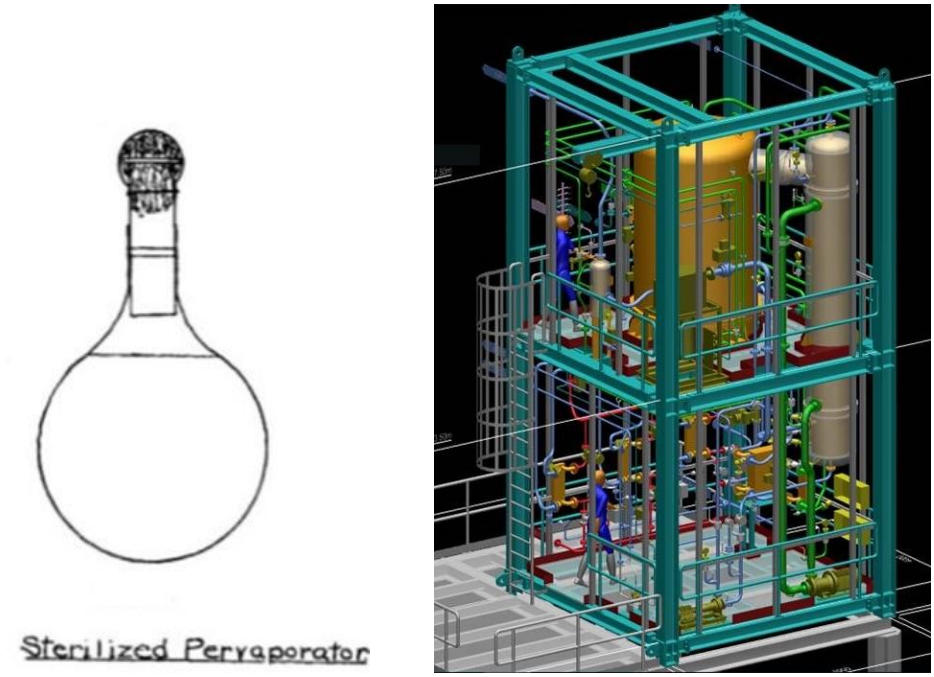

Fig. 1. The evolution of pervaporation; from a collodion bag (adapted with permission from [1], copyright 2017 American Chemical Society) to a skid-mounted plant [2].

References and Notes

[1] P.A. Kober, Pervaporation, perstillation and percrystallization, J. Am. Chem. Soc. 39 (1917) 944–948.
[2] 3D pervaporation plant drawing for solvent dehydration (DeltaMem AG).
[3] R.W. Baker, J.G. Wijmans, W. Huang, J. Membr. Sci. 348 (2010) 346-352.