

Process Intensification via Organic Solvent Nanofiltration – Recent Developments in Homogeneous Catalyst Recovery

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Abstract

Inherently, the application of transition metal homogenous catalysts provides several advantages compared to the use of heterogeneous catalysts, such as higher activity and easy control of selectivity. One of the main drawbacks is the high prize of precious transition metals and therefore, the separation and recycling of homogenous catalysts is a crucial challenge.

One method to increase the productivity of homogeneous catalysts and consequently, increase the economic value of a process is the application of organic solvent nanofiltration (OSN).^[1,2] Herein, we present two recently developed examples using OSN for catalyst recovery. One approach is the integration of a Poly-Ether-Ether-Ketone (PEEK) membrane in a continuous flow reactor to operate the well-known Palladium-catalyzed hydroamination of β -myrcene with morpholine.^[3] Yields and selectivities higher than 90% of the desired geranyl amines were obtained in a long-time stable process, while Palladium rejection higher than 90% was achieved in the dead-end membrane reactor (Figure 1).

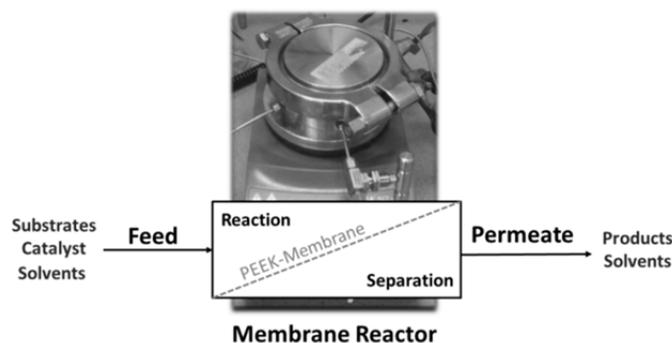


Figure 1: General process operation of the dead-end PEEK membrane reactor

The second approach for catalyst recovery is the application of a poly dimethylsiloxane (PDMS) membrane in the Rhodium catalysed hydroformylation of 1-dodecene to tridecanal. In a continuously operated miniplant process the potential of OSN was presented as a highly flexible, energy efficient and scalable separation technique. Over 100 h continuous flow operation yields higher than 90% of the desired aldehydes were obtained and a rejection higher than 95% regarding the precious Rhodium catalyst was achieved.^[4]

References

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