

Membrane enhanced chemical and biochemical processes: the effect of nanomodification of membrane surface on process efficiencies

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Growing population, global warming, surface water pollution are some of the major factors driving the virtuous global trend towards sustainability and resource efficiency across industry. Chemical industry is specifically striving to “intensify” processes making them more compact, safer, more energy-efficient, and environment-friendly. Process and discovery chemists are then challenged to optimize complex chemical synthesis that are as sustainable as the less efficient unit operations, and these are frequently separation, purification and isolation. Distillation and crystallization are reliable techniques, well established in chemical industry, but they are reaching their intrinsic limit calling for new more efficient solutions. Membrane technology is today an additional tool for process chemist, offering alternative and more efficient solutions to existing challenges.

This lecture will emphasize the vast application opportunities for membranes in liquid-phase reactions, highlighting the importance of surface chemistry on the global efficiency of the process. The presented cases will demonstrate how membrane technology can improve process efficiency in:

- Fine chemical industry, e.g. chemical process requiring high dilution or suffering from substrate inhibition; Re use and recycle of valuable homogeneous catalysts, substantially increasing TON numbers.
- White biotechnology and biocatalysis, e.g. continuous fermentation processes with integrated separation technology for whole cell fermentations; productivity increase of enzymatic chiral amines production through integrated membrane extraction.
- Recovery of valuable components from side streams and reduction of environmental impact of large scale manufacturing.