

## **Towards sustainable processes via membrane technology – application fields, design and evaluation**

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### **Abstract**

Organic solvent nanofiltration (OSN) is an innovative, sustainable technology for the separation of solutes dissolved in organic solvents. It offers significant energy saving compared to traditional thermal separation methods since it works without any phase change of the process solution. This allows a gentle separation and preserves the functionality of valuable substances. Thus, OSN enables innovative chemical processes to be designed comprising two advantages - economic efficiency and improved process sustainability.

Evonik is a leading-producer of OSN membranes, and applies this technology in-house in a wide range of processes to improve their sustainability and product yield. A prominent example at Evonik is the recovery and reuse of homogeneous catalysts from solvent-based reaction mixtures. The robustness of OSN technology has been proven in several applications at production scale over a long period of time, and this has demonstrated that the application of OSN technology can help to significantly reduce the operational costs of large scale industrial applications.

Other important use cases for OSN membranes include (1) solvent recovery from a variety of process streams, where the technology can be combined with thermal separation as a hybrid technique to make the separation more efficient, and (2) in the field of biofuels where OSN provides a sustainable, low energy technique to meet end user quality requirements.

As the range of applications for OSN technology is so diverse, there is always a requirement for increased membrane stability to access applications in more challenging process environments. This drives the development and use of alternative membrane materials for OSN, such as PEEK, which is a polymer characterized by very good chemical stability and is therefore an advantageous material from which to produce membranes. Despite the major challenges in processing this polymer to form membranes, we have succeeded in scaling up the production of a PEEK OSN membrane from lab-scale to reel-to-reel production. The newly developed membrane is suitable, for instance, for long-term application under extremely acidic conditions (pH ~ 1 equivalent) in a solvent environment.

In this lecture, we will provide examples how OSN is used at Evonik at an industrial scale to enhance sustainability and enable new processes and/or improve their profitability.