

Membrane Systems – Save Cost while Ensuring Safe Operation

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Abstract: The lecture focuses on the principles of the membranes filtration and demonstrates possibilities for making these processes more efficient and economical. After a short theoretical introduction on osmotic and filtration processes, possibilities for increasing performance on membranes systems will be shown, together with technical examples.

Keywords: Scaling; Fouling; Membranes

Introduction:

Since the first description of technical membrane processes, about 2'000 years ago, it has been taken a long time until membrane technologies were growing from smaller applications to large industrial processes. Today, membrane systems are used at various places for saving water as well as providing high quality water in challenging areas. Since suitable water quality is required nearly everywhere, the economic importance of membrane systems is growing from year to year.

For providing the required highly efficient membrane systems, a deeper understanding of the underlying theoretical background is necessary.

Material and Methods

There is a lot osmotic magic in water. It is well known that there is a transformation from chemical to physical energy at osmotic applications. But what is happening behind dissolution processes? Since VAN'T-HOFF's studies, we know that these effects are taking place in water under the gas phase principles. For transferring water through filtration processes, an energy intake higher than the osmotic pressure is required. In this way, the gaseous small water molecules can be guided to the membrane surface. But afterwards these small water molecules are missing on the hydrate shells of dissolved substances. This results in agglomeration and deposition

processes, which is highly undesirable from a technical point of view. A possible solution is speeding up the formation of small water molecules by adding thermal energy or a suitable heterogeneous catalyst.

Results and Conclusions

With special mineral-metal catalysts containing nickel, chromium and iron, it is possible to speed up the formation of hydrate shells. Such a solution is able to minimize negative effects of the energy intake on water in filtration processes. As a side effect the flux is improved and risk of deposits formation is minimized. Occasional interaction of low-energy visible light can additionally facilitate this process. The usage of this special catalyst technology results in a more efficient membranes filtration with optimized usage of chemicals. [1].

References

[1] Van Dijk, L.; Hubrich, H.; Koppe, J.; Kozariszczuk, M.; Luning, L.; Naves, A.; Niewersch, C.; Padilla Vivas, B.; Patrut, C.; Rastetter, N.; Remmen, K.; Wahlström, U. (2019), Innovative Solutions in the Process Industry for next generation Resource Efficient Water Management; Collaborative project; Innovation roadmap for demonstrated technologies; INSPIREWATER – D2.4 GA723702; 07/2019, 42-55