DESIGNING PERFORMANCE FILTER MEMBRANES FOR CHALLENGING & DEMANDING SEPARATION APPLICATIONS THROUGH ADVANCED CHARACTERIZATION TECHNIQUES

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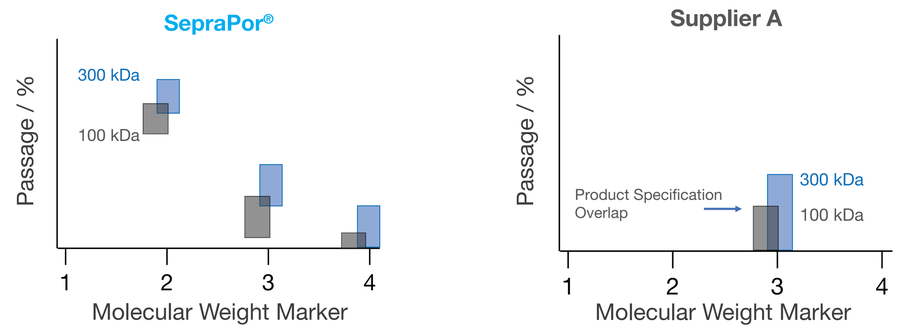
Abstract

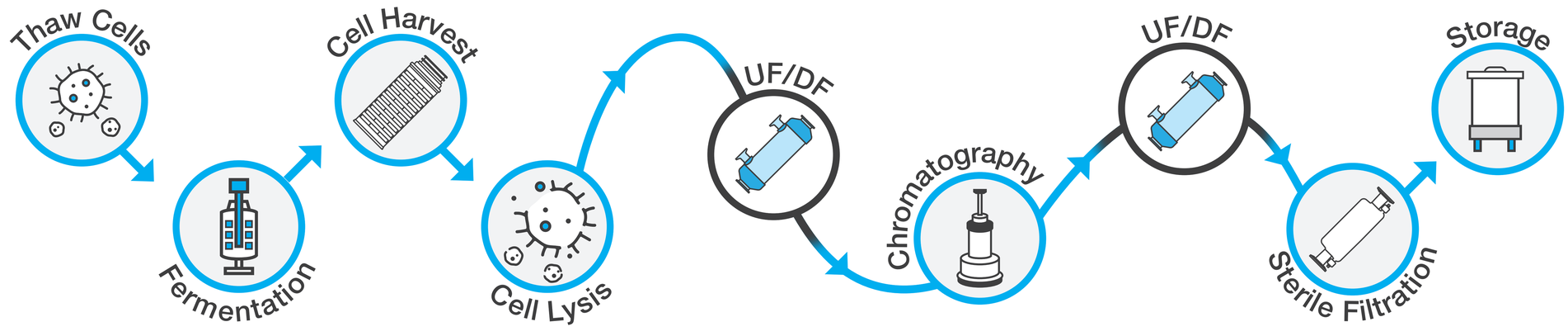
SepraPor® tangential flow filters using hollow fiber membrane technology are designed with the highest level of membrane consistency and uniformity available for bioprocessing in both microfiltration (MF) and ultrafiltration (UF) pore sizes. MF and UF membranes are characterized by narrow pore size range and water flux specifications, therefore ensuring more reproducible and consistent filtration for bioprocessing. Our efforts at improving membrane consistency and maintaining narrow product specifications are crucial elements for running bioprocesses at peak performance, consistently. Following is an application example of process intensification, using SepraPor® to accelerate concentration and buffer exchange when carrying out a plasmid DNA purification UF/DF.

UF Membrane Characterization



By using a minimum of three molecular weight (Mw) markers to characterize the molecular weight cut-off (MWCO) of a UF membrane, we are able to achieve well-defined MWCO membrane passages to ensure batch-to-batch consistency when performing process intensification in critical applications.

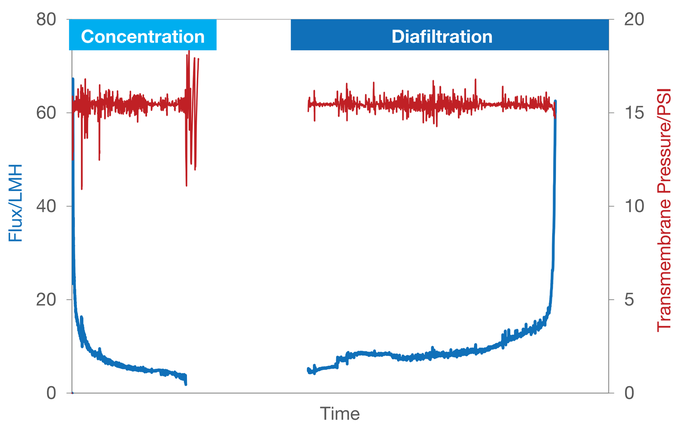
TFF Purification of pDNA



This generic pDNA manufacturing process diagram demonstrates that there are several critical UF/DF steps to ensure impurity removal and successful exchange of buffer for subsequent processing. Process intensification using SepraPor® UF hollow fiber filters in these manufacturing steps offer advantages, including minimized processing time, reduction in buffer volume requirements, and decreased effective filtration area (EFA) requirements.

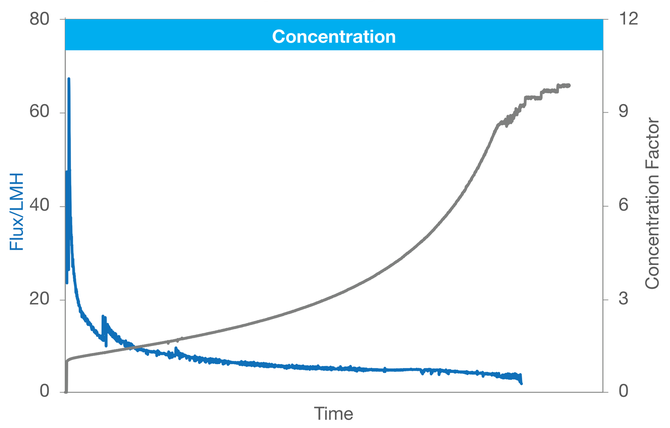
Improved Efficiency of Downstream UF/DF Processes

Stable TMP in Concentration & Diafiltration



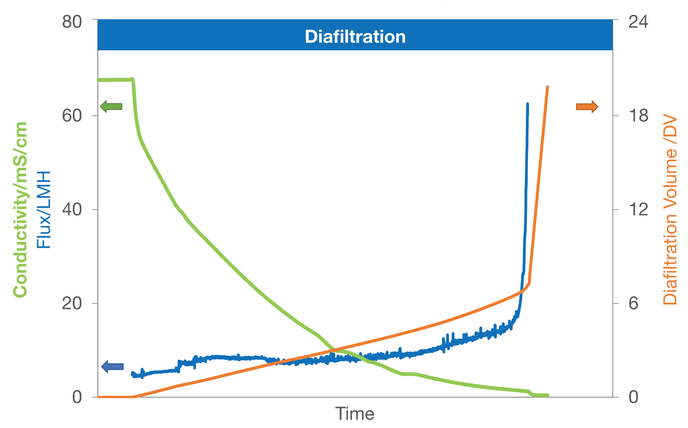
With transmembrane pressure (TMP) held constant, other relevant process parameters were monotored to evaluate the progress of the UF/DF process, such as flux, concentration factor, conductivity, and diafiltration volumes.

Efficient Concentration of pDNA lysate



The initial concentration step proceeded until the target concentration factor of 10 was achieved. As expected, with constant TMP the flux dropped over time due to the increase in solution viscosity and membrane loading as the product was concentrated.

Rapid Diafiltration for Buffer Exchange



During the diafiltration step, fresh buffer was introduced into the concentrated product and tracked in diafiltration volumes, effectively increasing the total solution volume and diluting the product in the new buffer. This step was continued until the conductivity reached 0.5 mS/cm, indicating completion of the buffer exchange step.

SepraPor® Hollow Fiber vs. Cassette

Comparison Data

	SepraPor® UF Filter	Cassette
Relative EFA	0.84 m²	1.5 m²
UF/DF Process Time	< 5 hours	> 8 hours
Feed Flow Rate	12 LPM	6 LPM
Concentration Factor	10x	10x
Diafiltration Volumes	14	20

Implementation of SepraPor® UF hollow fiber filters resulted in:

- 40% reduction in processing time
- Approximately 50% less membrane surface area required
- 25% less buffer required while maintaining the expected recovery yields and >98.5% product purity

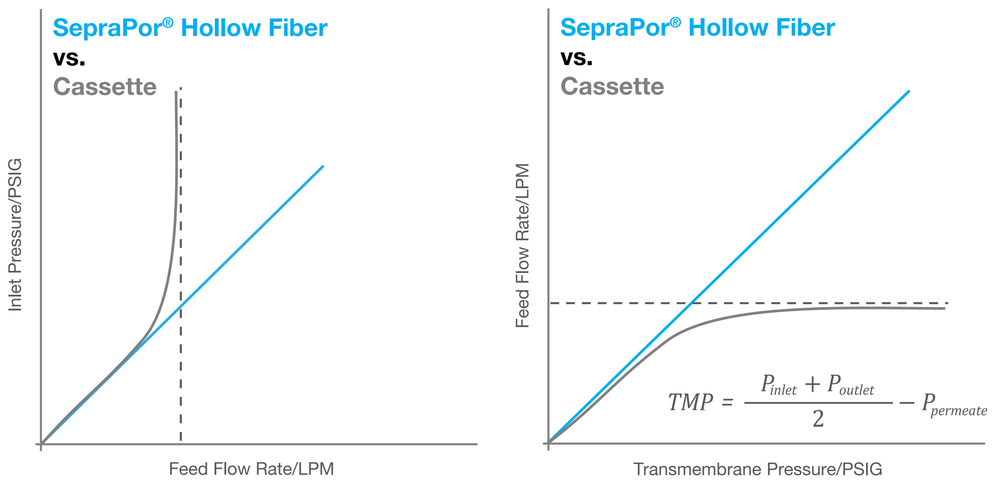


Plate-and-frame cassettes typically employ a tortuous flow path with restricted fluid entrance and exit openings. The restricted fluid inlet path results in a plateau in feed flow rate due to the accumulation of inlet back pressure. Alternatively, the hollow fiber form factor of SepraPor® UF filters allows for continuous increase in both pressure and feed flow rate, due to minimal fluid inlet restrictions.

Conclusion

SepraPor® ultrafiltration hollow fiber filters offer increased consistency and efficiency when compared with alternative TFF options. The filter's linear flow path is ideal for shear sensitive products and offers high flux for rapid processing.

Application Note
www.meissner.com/sepraporFor additional information, please contact: thomas.lazzara@meissner.com

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