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Application Note

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E. Coli Lysate Clarification – Optimal Shear Rate

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Abstract

This application note is focused on the performance on clarification of E. coli lysate to recover the 50 kD enzyme in the permeate. In this trial a Single-use Line Discover Module with the length of 41-inch in 750 kD and 0.1 µm was used. It was shown that the lysate clarification at the higher 7,000/sec shear rate compared to the 5,100/sec shear rate decreased the processing time by approximately 20%.

Introduction

Perform lysate clarification at two different shear rates to achieve a 10× concentration to identify an optimum shear rate.

Materials

For this clarification process two Single-use Line Discover with a length of 41-inch and a molecular weight cut-off (MWCO) of 750 kD with 1.0 mm fiber ID were used. The filter area of each module is 0.0193 m^2 .Like all our Hollow Fiber Modules the membrane consisted of modified Polyethersulfon (m-PES).

Details of used Hollow Fiber Module

Family	Single-use
Product Size	Discover
MWCO | Pore Size	750kD
Fiber ID	1.0 mm
Length	41 inch
Filter Area	0.0193 m^2
No. of Fibers	6
Recommended batch volume per module	80 – 850 mL
Diameter Module (cm)	0.95 cm
Feed | Retentate connectors	Luer Lock
Permeate connector	Luer Lock
Order Code	SU75010DIS41L6 (6-pack)

Methods

In this application lysate clarification was performed with two different shear rates to achieve a 10× concentration to identify an optimum shear rate. Therefore, two Single-use Line Discover Modules with a MWCO of 750 kD were used.

Lysate Clarification (10× Concentration)	**Module 1: Single-use Line Discover 41" (193 cm^2), 750 K, 1 mm fiber ID**	**Module 2: Single-use Line Discover 41" (193 cm^2), 750 K, 1 mm fiber ID**
Process Volume	1.1 L	
Membrane Loading	50 L/m^2	
Shear rate	5,100/sec^{-1}	7,000/sec^{-1}
Flux Rate	12	24
Process time	4 hr	3 hr 20 min

Results

Lysate clarification used the 750 kD membrane and for comparison two different shear rates were used: 5,100/sec and 7,000/sec. Membrane performance targets were to maintain a stable permeate flux 20 LMH and a volume loading of 50 L/m^2. The trial at 5,100/sec shear rate had an increase in TMP and a corresponding decrease in permeate flux after approximately 3 hours of processing. For this trial, the total time to achieve 10× concentration was 4 hours (Graph 3). The trial at 7,000/sec shear rate had a stable TMP and permeate flux throughout the approximately 3 hour 20 minute process to reach 10X concentration (Graph 4). When comparing the TMP profiles for these trials, the maximum TMP of 30 psig was similar for both membranes. Because the processing time was significantly less at the higher shear rate and the permeate flux was maintained during these conditions, the higher shear rate of 7,000/sec would be used for this step.

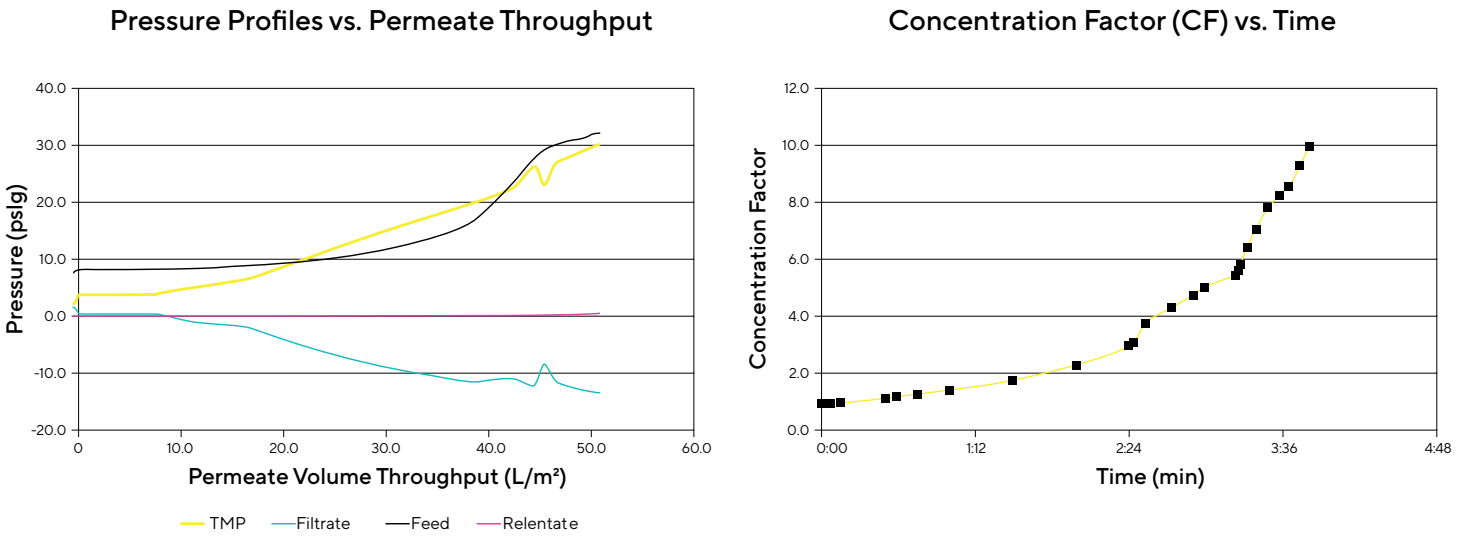

Figure 1: (Left) Pressure profile vs. permeate throughput for Module 1 at 5,100/sec shear; (Right) concentration factor vs. time for Module 1 at 5,100/sec shear

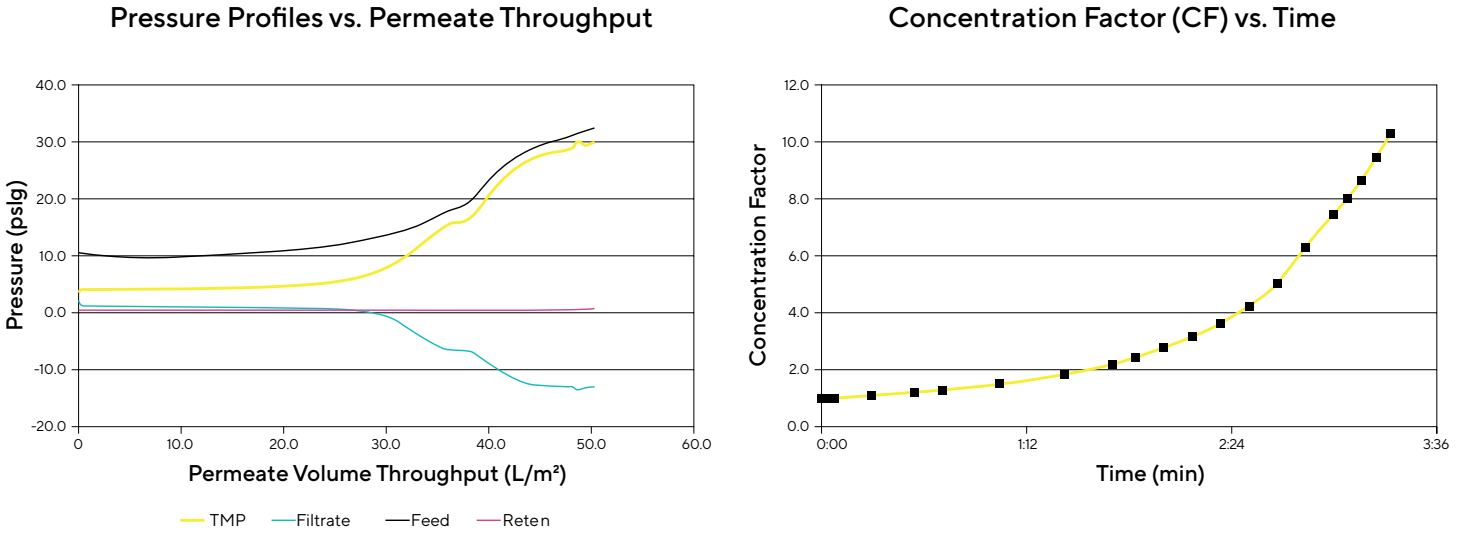

Figure 1: (Left) Pressure profile vs. permeate throughput for Module 2 at 7,000/sec shear; (Right) concentration factor vs. time for Module 2 at 7,000/sec shear

Conclusion

The lysate clarification at the higher 7,000/sec shear rate compared to the 5,100/sec shear rate decreased the processing time by approximately 20%.

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