



# Process Simulation of Virus Clearance Using a Mobius® FlexReady Solution

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## SUMMARY

Two complete process simulations were executed in Millipore's BioManufacturing Sciences Lab. The objective of this study was to demonstrate the speed and efficiency at which the Mobius FlexReady Solution for Virus Filtration allows a user to perform a virus filtration process. The first run used a prefilter with a Viresolve® Pro Modus device, and the second run used only a Viresolve Pro Modus device. The Mobius FlexReady system functioned appropriately for both runs. The mode of operation (constant pressure with a peristaltic pump) on the system achieved the constant pressure requirements for the device. The results were comparable to a small-scale Viresolve Pro Micro device.

## INTRODUCTION

The Mobius FlexReady Solution for Virus Filtration is designed to run a virus clearance application. The basic process steps tested were:

- Flushing the optional prefilter
- Flushing the Viresolve Pro Modus device
- Pre-use integrity test of Viresolve Pro Modus device using Millipore's Integritest® 4 integrity tester
- Post integrity testing (IT) WFI flush
- Buffer equilibration
- Product filtration
- Post-use buffer flush
- Post-use WFI flush and integrity test of Viresolve Pro Modus device using Integritest 4 integrity tester

## PROCEDURES

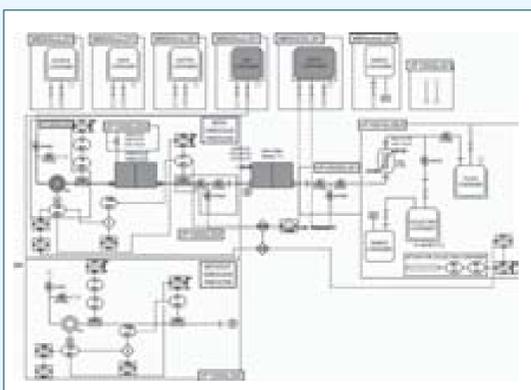
The Mobius FlexReady hardware system was quickly set up in a lab and the Flexware® assemblies connected and assembled onto the system following user guide instructions.

The following sterile-filtered solutions were used: WFI, buffer (100 mM NaCl, 50 mM Sodium Acetate, pH = 5) and feed (0.1 g/L Seracare™ IgG).

The prefilter used was the Viresolve Prefilter Pod device MA1HC027H1, lot no. CP7CN52291, serial no. 000000149 (270 cm<sup>2</sup>). The Viresolve Pro device used on the first run was a Modus 1.1, lot no. 2008J4013, serial no. 77, and contained membrane lots M120607AVP-1 / M120307AVP-3 (170 cm<sup>2</sup>). The Viresolve Pro device used for the second run was a Modus 1.1, lot no. 2008J4013, serial no. 81, and contained membrane lots M120607AVP-1 / M120307AVP-3 (170 cm<sup>2</sup>). The sterile filter used in both runs for the Viresolve Pro filtrate into the product bag was an Opticap® XL 600 capsule KHGEG006HH3, lot no. C7KN88229, serial no. 003 (600 cm<sup>2</sup>).

On each day, small-scale filters were run to compare the performance from a scalability and mode of operation perspective (constant pressure with a compressed air vs. constant pressure with a peristaltic pump). The Viresolve Pro Micro devices used for all of the small-scale work contained membrane lot no. M112607AVP-3.

### Basic Schematic of a Flexware Configuration



## RESULTS

### RUN 1: FULL PROCESS WITH THE PREFILTER

Figure 1: Flushing the Prefilter

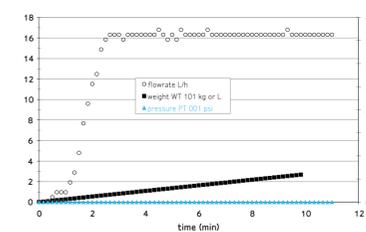


Figure 2: Flushing Viresolve Pro Modus Device

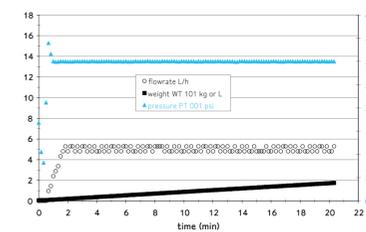


Figure 3: Post Integrity Test WFI Flush

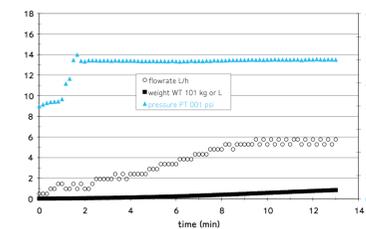


Figure 4: Buffer Equilibration

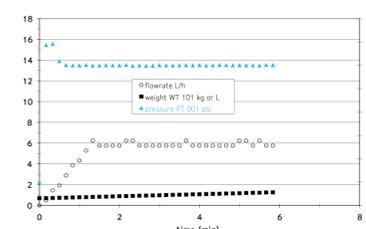


Figure 5: Product Filtration

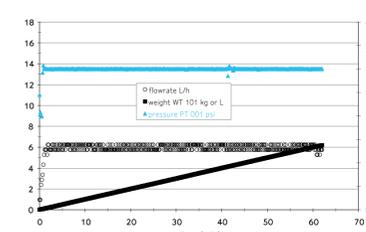
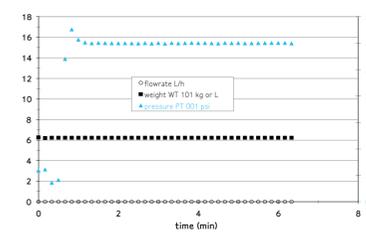
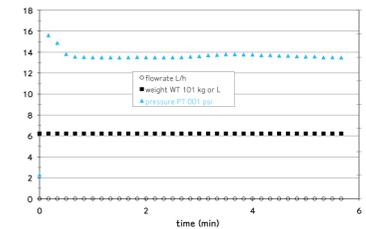


Figure 6: Post-use Buffer Flush



Note: Filtrate was collected manually off the scale (which is why the filtrate weight did not change and why the flow rate is zero). The process step was stopped based on the system timer, which is another option for process control.

Figure 7: Water Wet for Post use Integrity Test



Note: Filtrate was collected manually off the scale (which is why the filtrate weight did not change and why the flow rate is zero). The process step was stopped based on the system timer, which is another option for process control.

### RUN 2: FULL PROCESS EXCLUDING PREFILTER

Figure 8: Water Flush of Viresolve Pro Modus Device without Prefilter (RUN 2)

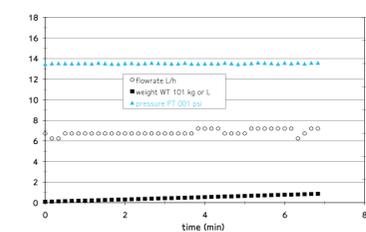


Figure 9: Post Integrity Test Water Wet

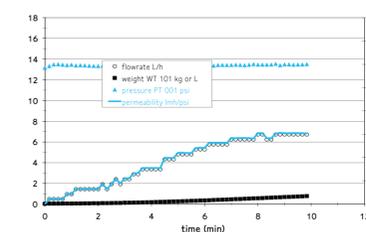
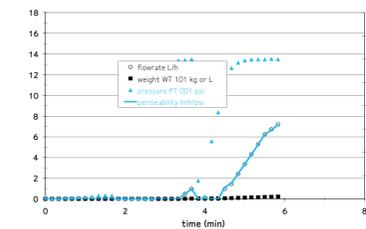


Figure 10: Equilibration



Breaks in the data were the result of the manual pausing of the system. Once buffer permeability (~15.9 Lmh/psi) was established, it was entered in the permeability alarm settings to control the batch.

Figure 11: Product Filtration

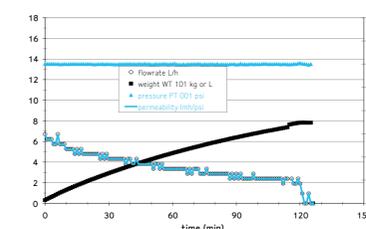


Figure 12: Post Product Buffer Flush

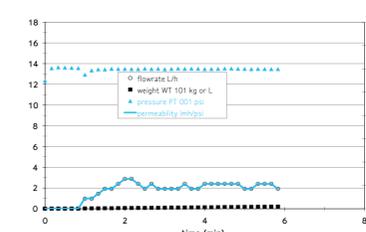
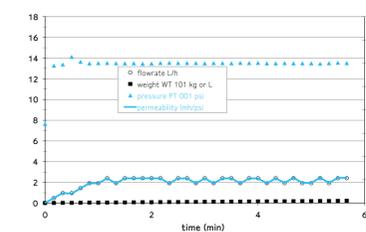


Figure 13: Post Product Water Flush



### SCALABILITY STUDY

Figure 14: Viresolve Pro Device Performance with 0.1g/L Seracare IgG

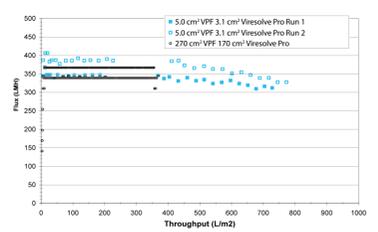
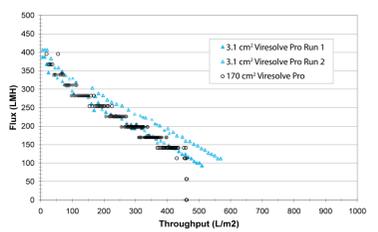


Figure 15: Viresolve Pro Device Performance with 0.1g/L Seracare IgG



## CONCLUSION

The Mobius FlexReady System enables users to quickly and easily perform all steps necessary for a virus filtration unit operation. The prefilter vented easily, and at the recommended 90% fixed pump speed for the Viresolve Pro device flush produced the recommended flow rate of 16 L/h or 600 LMH for the 0.027 m<sup>2</sup> Viresolve Pro device (Figure 1). The system scale and timer tracked flow rate effectively and the timer shut the system down on queue to complete the batch. The Viresolve Pro Modus device was easily vented and the system controlled the pressure at 30 psi (Figure 2). The system set up enabled the Viresolve Pro Modus device to be easily integrity tested on the skid using an automatic integrity tester. The system flushed the Viresolve Pro Micro device post integrity testing (Figure 3) effectively. The small-scale Viresolve Pro device testing showed similar performance to the Mobius FlexReady Solution (Figure 14). Constant pressure with compressed air vs. constant pressure with a peristaltic pump used on the Mobius FlexReady Solution did not impact the filter performance (Figure 15).

