Millipore®
Preparation, Separation,
Filtration & Testing Products

Data Sheet

Viresolve® Barrier Filters

A powerful upstream viral safety solution designed to prevent bioreactor contamination

Multiple potential sources of adventitious virus exist within a manufacturing environment, putting your upstream process at risk for contamination. Bioreactor contaminations are highly disruptive and costly events, but the risk of contamination can be minimized with an appropriate viral safety strategy.

Viresolve® Barrier filters provide robust, efficient, easy-to-implement and use bioreactor protection. They are specifically designed for processing chemically defined cell culture media without impacting media composition, performance, or resulting protein quality. Viresolve® Barrier filters retain high levels of virus, mycoplasma, and bacteria, including spirochetes, while providing high flow and capacity.

Available in a range of sizes, Viresolve® Barrier single-use capsule filters provide scalable performance from process development to large-scale manufacturing. These filters can replace sterile filters and can be used in front of bioreactors or media storage containers.

Benefits

Robust protection from adventitious agents

- ≥ 3.0 log removal of parvovirus
- ≥ 6.0 log removal of mycoplasma
- Sterilizing-grade protection from bacteria
- 100% integrity tested in manufacturing, ensuring quality and consistency

Efficient virus filtration of cell culture media

- No impact to cell culture media performance
- High-flux virus filtration
- Easy to implement, install, and integrity test

Scalable Filter Formats

- Small-scale process development kit – presterilized
- Capsule filters – gamma compatible, and can be integrated into presterilized Mobius® single-use assemblies

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Expand your Upstream Risk Mitigation Strategy

Until recently, upstream viral contamination risk mitigation relied on careful sourcing of raw materials, testing of cell banks, and control of facilities and workflow. Despite these precautions, viral contaminations occurred.

New technologies have been developed to reduce upstream viral contamination risks. However, they often require costly investment and/or are not suitable for all media components. In comparison, upstream virus filtration is an easy-to-implement and use option that is compatible with chemically defined cell culture media.

Upstream Virus Prevention

Cell culture media treatment requirements	Viresolve® Barrier filter	High temperature short time (HTST)	UV-C inactivation	Gamma irradiation
Robust parvovirus clearance	✓	Virus and system dependent	Virus and system dependent	Virus and system dependent
Point of use implementation	✓	✓	✓	
Easy to scale	✓			
Small footprint	✓			
Easy to implement and use	✓		✓	✓

Viresolve® Barrier Filters

Viresolve® Barrier filters contain a polyethersulfone (PES) membrane that efficiently removes viruses from cell culture media. These capsule filters provide robust filtration performance and high virus retention without impacting cell culture media performance. They are available in a range of sizes suitable for all processes, and are an ideal solution for reducing the risk of bioreactor contamination.

Micro Filters (Process Development Kit)

- Small-volume tool for process development, optimization, and sizing studies
- Includes nine presterilized devices made from one membrane lot
- Vented to prevent air locking

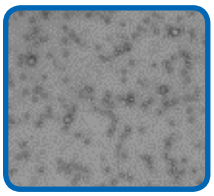
Capsule Filters

- Pilot, medium, and large-volume processing
- Gamma compatible; can be integrated into presterilized Mobius® single-use assemblies
- Easy to implement and use
- 100% integrity tested in manufacturing

Robust Clearance

Viresolve® Barrier filters were challenged with several microorganisms of varying size and shape. The experimental results, outlined here, demonstrate the robust retention performance of this filter.

Virus

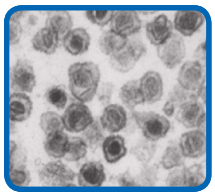


Minute virus of mice (MVM)

Relevant parvovirus contaminant

Target organism

Typical LRV above 4

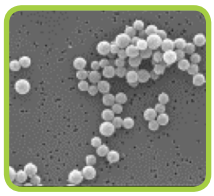


Murine leukemia virus (x-MuLV)

Model large virus

LRV >6

Mycoplasma

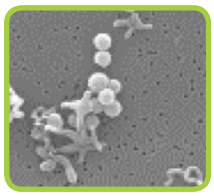


A. laidlawii

Standard model mycoplasma

Model organism for 0.1 µm filters

LRV >8



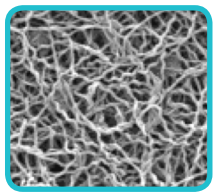
M. orale

Relevant contaminant

Can penetrate 0.1 µm filters

LRV >8

Spirochete



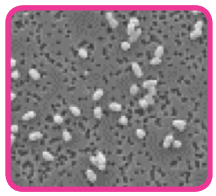
L. illini

Model spirochete bacteria

Can penetrate 0.1 µm filters

LRV >8

Bacteria



B. diminuta

Standard model bacteria

Tested by ASTM® F838-05

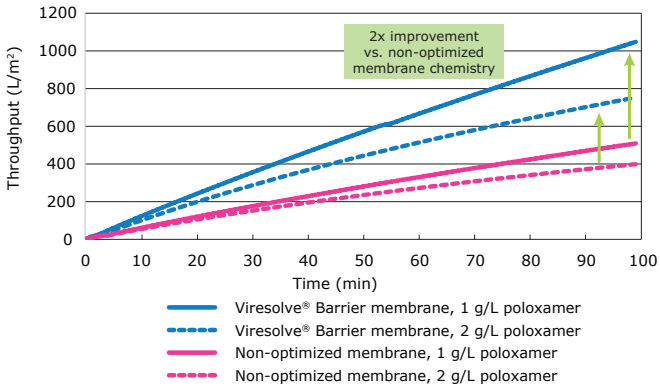
LRV >8

Fast, Efficient Processing

Viresolve® Barrier filters provide high-flux performance across a broad range of chemically defined media compositions.

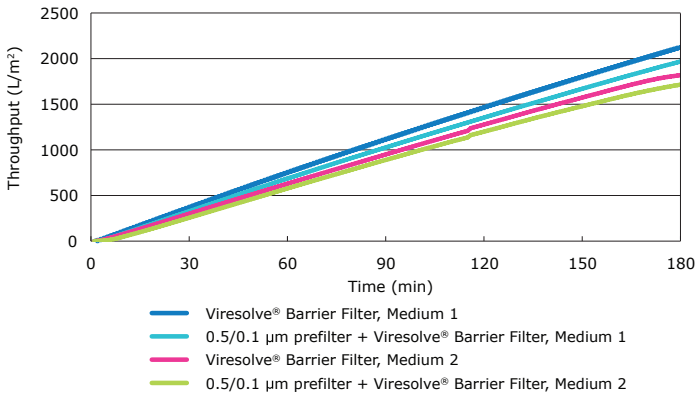
Viresolve® Barrier filters contain PES membrane with an optimized secondary chemistry to ensure compatibility with challenging medium components such as poloxamer.

Membrane Optimized for Poloxamer-containing Media



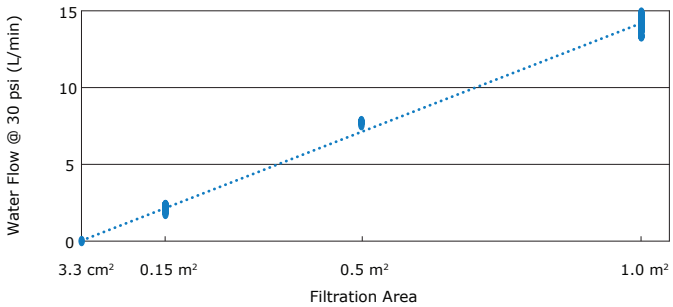
Many Media Do Not Require a Prefilter

Medium 1 = chemically defined
Medium 2 = hydrolysate-containing



Linear Scalability: Micro Filter through Largest Capsule

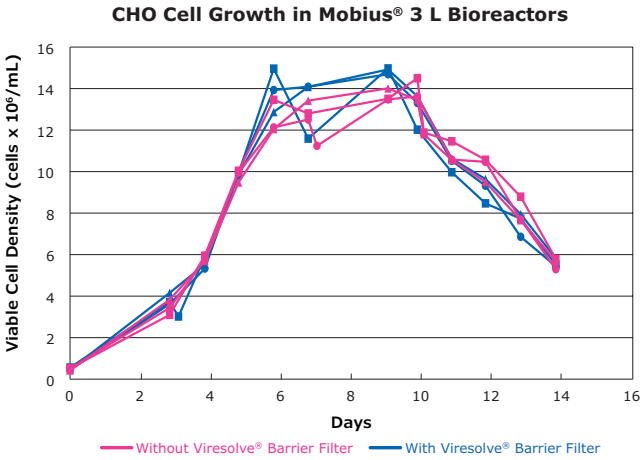
Scalability also evaluated for throughput of a model cell culture medium (not shown); results for all sizes within 5% of micro filter

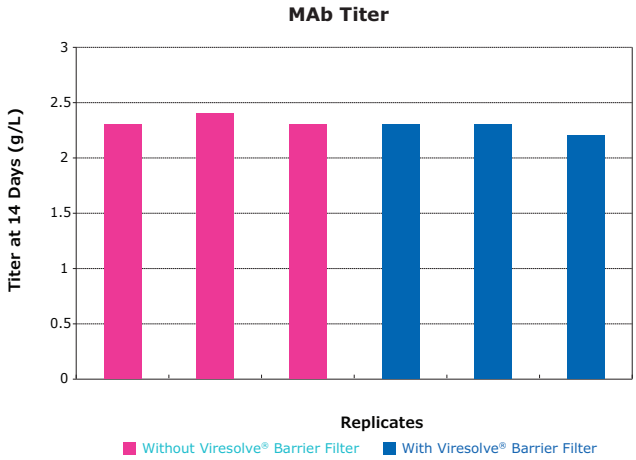


Maintaining Cell Culture Performance

Monoclonal antibody-producing cell culture processes were evaluated using media analytics, cell growth studies, and protein quality assays to determine the effect of media filtration with Viresolve® Barrier filters. Analysis of media composition (NMR, ICP-OES, HPLC) showed no impact from virus filtration. CHO cell culture showed comparable cell growth, viability, and productivity using Viresolve® Barrier filtered media compared to sterile-filtered media.

There were no significant differences in resulting protein quality attributes between material generated from bioreactors with and without Viresolve® Barrier filtered media. Protein quality attributes such as glycan profile, charge variants, and aggregate profile were comparable following Viresolve® Barrier filtration of the cell culture media.



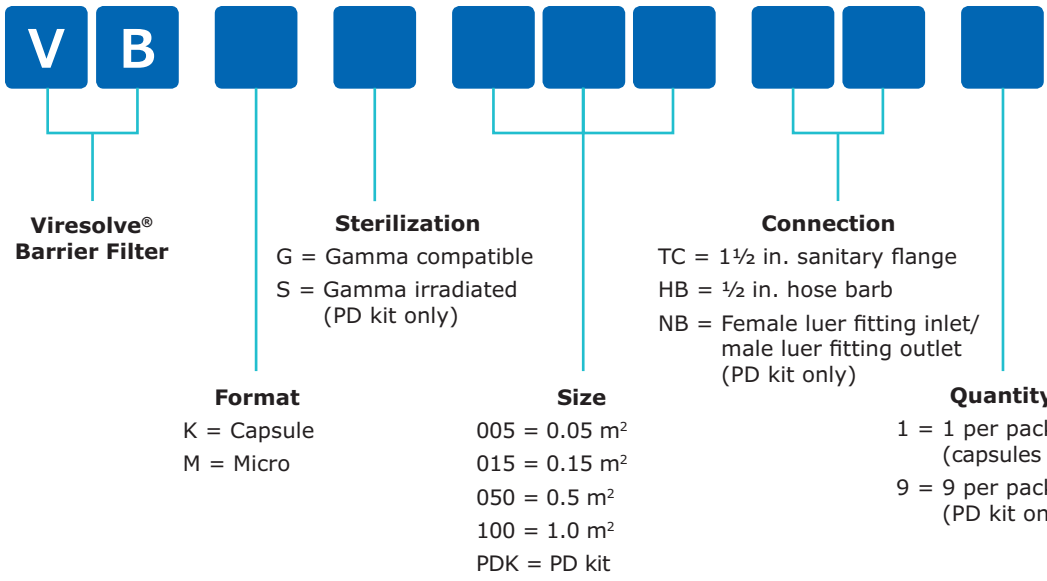


Specifications

Viresolve® Barrier Filters

Membrane Area	3.3 cm^2 Micro Filter	0.05 m^2 Capsule Filter	0.15 m^2 Capsule Filter	0.5 m^2 Capsule Filter	1.0 m^2 Capsule Filter
Nominal Dimensions	Height: 3.8 cm (1.5 in.) Diameter: 3.1 cm (1.2 in.)	Height: 23.6 cm (9.3 in.) Diameter: 19.0 cm (7.5 in.)	Height: 23.6 cm (9.3 in.) Diameter: 19.0 cm (7.5 in.)	Height: 29.7 cm (11.7 in.) Diameter: 19.0 cm (7.5 in.)	Height: 39.6 cm (15.6 in.) Diameter: 19.0 cm (7.5 in.)
Materials of Construction	Membrane: Polyethersulfone (PES) Housing: Gamma-stable polypropylene	Membrane: Polyethersulfone (PES) Support layer: Polyethylene Housing: Gamma-stable polypropylene, polyethersulfone O-rings: Silicone, EPDM			
Standard Connections	Inlet and Vent: Female luer fitting Outlet: Male luer fitting	Inlet and Outlet: ½ in. hose barb (HB) or 1½ in. sanitary flange (TC) Vents: ¼ in. hose barb on inlet end of capsule; fractional sanitary flange on outlet end of capsule			
Good Manufacturing Practice	Filters are manufactured in a facility that adheres to Good Manufacturing Practices.				
ISO® 9001 Quality Standard	Filters are manufactured in a facility whose Quality Management System is approved by an accredited registering body to the appropriate ISO® 9001 Quality Systems Standard.				
Particulate and Bioburden	Filters are manufactured in an ISO® Class 8 (per ISO® 14644-1) controlled environment for particulate classification only.				
Animal Origin	Component materials are either animal free or in compliance with EMEA/410/01.				
USP <87> Biological Reactivity Tests	Component materials were tested and meet the criteria for non-cytotoxicity for the USP <87> Cytoxicity MEM Elution Tests.				
USP <88> Biological Reactivity Tests	Component materials were tested and meet the criteria for USP <88> Biological Reactivity Tests for Class VI Plastics.				
Bacterial Endotoxin	An aqueous extract contains less than 0.25 EU/mL, per USP <85>, as determined by the Limulus Amebocyte Lysate (LAL) test.				
Non-particle Releasing	Filters meet the requirements of USP <788>.				
Membrane Bacteriophage Retention	Membrane samples exhibited LRV ≥ 4 using ΦX-174 bacteriophage at a minimum challenge level of 10^7 pfu/mL in the presence of a chemically defined cell culture medium.				
Device Bacteriophage Retention	Filters are manufactured with retentive membrane, as detailed above.	Filter samples exhibited LRV ≥ 4.0 using ΦX-174 bacteriophage at a minimum challenge level of 10^7 pfu/mL.			
Mycoplasma Retention	Membrane samples exhibited LRV ≥ 6.0 using *A. laidlawii* ATCC® 23206 and our validated test method.				
Bacterial Retention	Membrane is validated as sterilizing grade.	Membrane and filters are validated as sterilizing grade – quantitatively retentive of a minimum *B. diminuta* challenge of 10^7 CFU/cm^2 using ASTM® F838-05 methodology.			
Sterilization	Filters were gamma irradiated at 25-40 kGy.	Filter integrity and performance characteristics are maintained after exposure to a maximum gamma radiation dose of 40 kGy.			
Maximum Differential Pressure	Forward: 4.1 bar (60 psi) at 25 °C	Forward: 4.1 bar (60 psi) at 25 °C Reverse: 0.3 bar (5 psi) at 25 °C			
Hydraulic Stress Test		Samples were integral based on an air/water diffusion test, before and after repeated forward stress to 4.1 bar (60 psi) at 25 °C.			
100% Integrity Tested in Manufacturing	Each filter passed an aerosol particle challenge.	Each filter exhibited less than or equal to the following air diffusional flow rates at 3.4 bar (50 psi) in water, at 23 °C: - 0.05 m^2: 2.2 cc/min - 0.15 m^2: 6.6 cc/min - 0.5 m^2: 22 cc/min - 1.0 m^2: 44 cc/min			

Ordering Information



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Lit No. DS1401EN00 Ver. 1.0
2016-00378
12/2017