cobetter®
filtration

Viruclear VF Series
Virus Removal Filter

Viruclear VF Series
plastic housing cassette

Viruclear VF

Reliable & Effective Virus Removal Filter

Virus filtration is a robust virus clearance method in the production process of common biopharmaceutical products. Due to its simple and gentle operation, clear mechanism, and easy verification, it has been widely used in the downstream purification process of blood products such as coagulation factors, immunoglobulins, and recombinant proteins and antibody biological products expressed in animal cells to ensure virus safety.

The most widely used virus filtration product is the 20nm pore size parvovirus removal filter in the current market. Size exclusion is the main mechanism of virus removal. The target products with molecular sizes smaller than the pore size of the membrane can pass through the membrane, and the virus with sizes larger than the membrane pore size can be intercepted.

Based on its physical interception characteristics, whether the diameter of 80-120 nm mouse leukaemia virus is a retrovirus or the diameter of about 20 nm of parvovirus, can be reliable and efficient interception. Virus clearance meet regulatory requirements that log reduction values (LRV)≥4 log.

Cobetter Viruclear VF series virus removal filters features an asymmetric polyethersulfone (PES) membrane, greatly improve the fouling space, and provides strong interception and removal fouling for protein aggregates and potential viruses. The part near the water surface consists of a precision retention layer with about 20 nm and the pore size distribution is uniform, which can achieve robust retention of parvovirus and robust retention maintained during process interruption/depressurization. Cobetter Viruclear VF series virus removal filters also provide good scalability, while integrity testing using an easy-to-operate diffusion flow method.

Features

· Unique surface hydrophilic improvement of PES membrane , which gives high mass capacity and high yield of virus retentive membrane
· Asymmetric membrane structure, high porosity, and high flux
· Robust removal of parvovirus
· ≥ 4.0 log removal of model virus
· Robust retention maintained during process interruption
· Chemically stable
· Easy to install, use and test

Typical Applications

Monoclonal Antibody
Bispecific Antibody (BsAb)
Antibody-Drug Conjugate(ADC)
Fusion Proteins
Nanobody
Recombinant Proteins

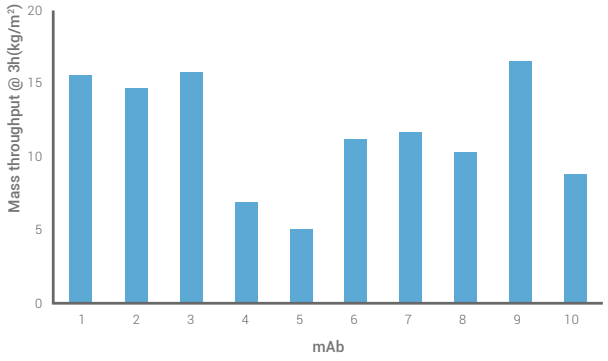
Viruclear™ VF

PES Virus Removal Filters for Antibody Processing

Cobetter Viruclear™ VF virus removal membrane utilizes a highly hydrophilic formulation, effectively enhancing the hydrophilicity of the PES membrane. The Viruclear™ VF filter enables robust linear process scalability and supports inline integrity testing. It is designed primarily for purification applications of biologics, including mammalian cell-expressed recombinant proteins, mAbs, ADCs, and high-purity/stability bispecific antibodies.

Excellent Product Adaptability

The virus removal performance of protein solutions is strongly correlated with the intrinsic properties of the solution. Product with high protein concentration, low purity, high hydrophobicity, or containing stabilizing agents typically pose greater challenges to virus filtration. The figure presents representative examples of the filtration performance of Viruclear™ VF when processing different customer protein solutions.



Viruclear™ VF achieves a mass loading of 5–16 kg/m² across various customer mAb products during a 3-hour filtration at a constant pressure of 2.0 bar.

This demonstrates that Viruclear™ VF offers high mass throughput, meeting the filtration loading requirements for most mAbs.

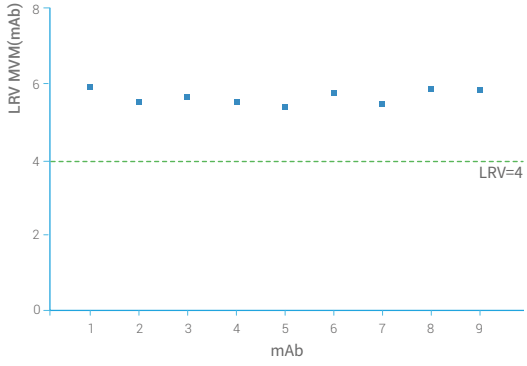
Robust Removal of Virus

Test Condition

Viruclear VF syringe filters performed MVM challenge experiments on multiple customer mAb batches at room temperature and 30 psi.

Filter	Viruclear VF syringe filter
Model virus	MVM
Feed solution	mAb protein solutions from different customers
Constant pressure	30 psi
Flux decay	Decay to 25% of initial flux or target loading achieved

Test results



Viruclear™ VF product possesses robust virus clearance capability, effectively ensuring stable virus retention exceeding regulations. Meanwhile, addressing worst-case conditions in production—pressure interruption, Viruclear™ VF still ensures robust virus retention

Viruclear™ VF Plus

Strength-Optimized PES Virus Removal Filter

Through optimized membrane fabrication, Cobetter introduces Viruclear™ VF Plus, featuring enhanced structural strength and improved manufacturing yields. For certain products, VF Plus delivers superior filtration performance.

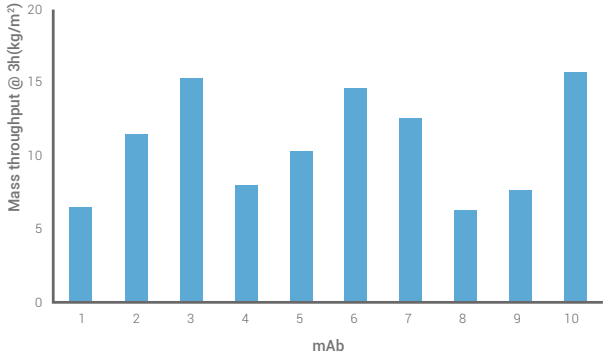
Both Viruclear™ VF Plus and Viruclear™ VF are designed for virus filtration in biologics, including recombinant proteins, mAbs, ADCs, and high-purity bispecific antibodies. Users should select the most suitable model based on process development test results.

Excellent Product Adaptability

The virus removal performance of protein solutions is strongly correlated with the intrinsic properties of the solution.

Product with high protein concentration, low purity, high hydrophobicity, or containing stabilizing agents typically pose greater challenges to virus filtration.

The figure presents representative examples of the filtration performance of Viruclear™ VF Plus when processing different customer feed materials.



Viruclear™ VF Plus achieves a mass loading of 6–15 kg/m² across various customer mAb products during a 3-hour filtration at a constant pressure of 2.0 bar.

This demonstrates that Viruclear™ VF Plus offers high mass throughput, meeting the filtration loading requirements for most mAbs.

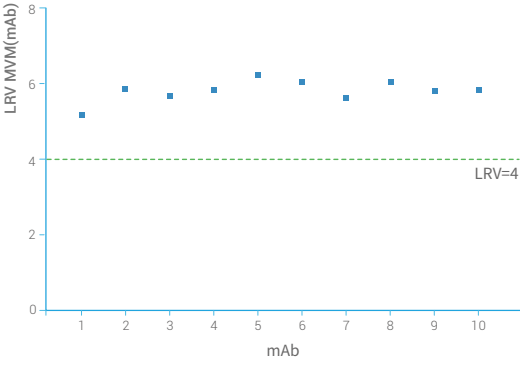
Robust Removal of Virus

Test Condition

Viruclear VF Plus syringe filters performed MVM challenge studies on multiple customer mAb batches at room temperature and 30 psi.

Filter	Viruclear VF Plus syringe filter
Model virus	MVM
Feed solution	mAb protein solutions from different customers
Constant pressure	30 psi
Flux decay	Decay to 25% of initial flux or target loading achieved

Test results



Viruclear™ VF Plus product possesses robust virus clearance capability, effectively ensuring stable virus retention exceeding regulations. Meanwhile, addressing worst-case conditions in production—pressure interruption, Viruclear™ VF still ensures robust virus retention

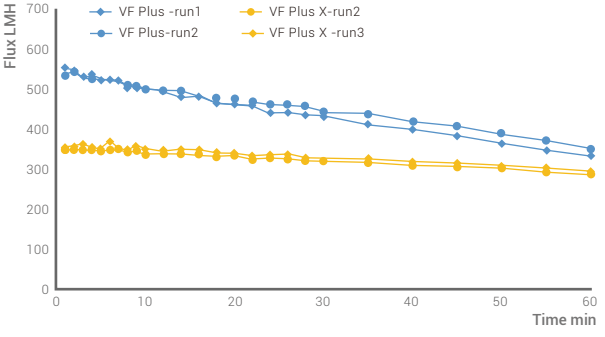
Viruclear VF Plus X

Enhanced Capacity PES Virus Removal Filter

Viruclear™ VF Plus X further enhances membrane dirt holding capacity. It has better adaptability to complex products and higher mass or volume capacity at the expense of a certain water flux, especially suitable for biological products with high protein aggregates content and poor stability, such as bevacizumab, unstable bispecific antibodies and fusion proteins. Viruclear VF Plus X is a supplement and alternative to Viruclear VF Plus in the fields of recombinant protein and antibody applications, and can take care of both filtration applications for some biological enzymes and low concentration blood products.

Enhanced Fouling Resistance

The comparative experiments on the filtration performance of Viruclear™ VF Plus and Viruclear™ VF Plus X were conducted under room temperature and constant-pressure filtration conditions of 30 psi, with parallel experiments filtering the same 0.4 g/L intravenous immunoglobulin (IVIG) solution used as the loading evaluation solution. The comparison of filtration flux decay trends can reflect the differences in filtration performance among the filters.The comparison of flux decay trends demonstrates the enhanced fouling resistance of Viruclear™ VF Plus X.



Viruclear™ VF Plus and Viruclear™ VF Plus X
Comparison of Flux decay with time when filtering the same solution

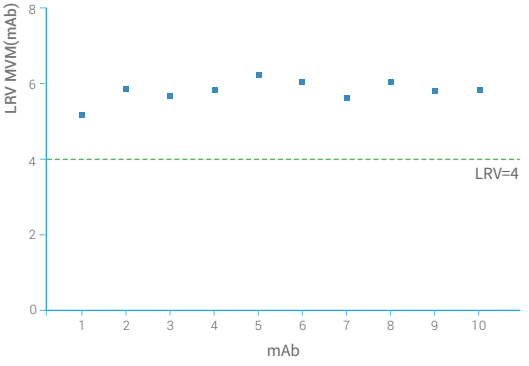
Robust Removal of Virus

Test Condition

Viruclear VF Plus X syringe filters performed MVM challenge studies on multiple customer mAb batches at room temperature and 30 psi.

Filter	Viruclear VF Plus X syringe filter
Model virus	MVM
Feed solution	mAb protein feedstreams from different customers
Constant pressure	30 psi
Flux decay	Decay to 25% of initial flux or target loading achieved

测试结果



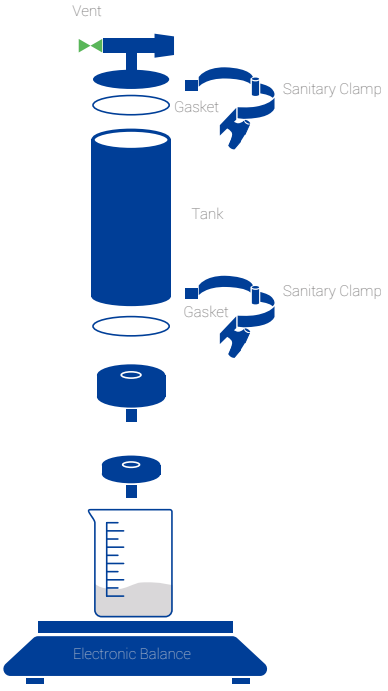
Viruclear™ VF Plus X product possesses robust virus clearance capability, effectively ensuring stable virus retention exceeding regulations. Meanwhile, addressing worst-case conditions in production—pressure interruption, Viruclear™ VF Plus X still ensures robust virus retention

Virus Removal Filtration Process Development Service

Our technical engineers will work with customers to optimize the process parameters during the process development of virus removal filtration to obtain a robust, efficient and economical filtration operation.

Virus Removal Filterability Testing Device

Virus Removal Assembly Sketch Map



Specification

	Specification	Effective Filtration Area	Application
Viruclear™ VF Virus Removal Filter	DC series	2.8cm²	For process development and virus clearance validation research
	Pilot scale	0.017/0.07/0.22m²	≤200L
	Production scale	0.50/1.50m²	＞200L

Material of Products

	Specification	Membrane	Format	Shell	Effective Filtration Area	Assessries material
Viruclear™ VF Series	DC series	PES	Syringe filter	PVDF	2.8cm²	——
	Pilot scale	PES	Single-use Plastic-housing Cassette	PVDF	0.017/ 0.07/ 0.22m²	Silicone, PP
	Production scale	PES	Single-use Plastic-housing Cassette	PVDF	0.50 / 1.50m²	Silicone, PP
Corevital™ SMDA Series	DS series	PVDF	Syringe filter	PP	0.72/3.4/4.5cm²	——
	Pilot scale	PVDF	Single-use Plastic-housing Capsule	PP	180/420/660cm² 0.12/0.16/0.28m²	Silicone rubber
	Production scale	PVDF	Single-use Plastic-housing Capsule	PP	0.55/1.1/1.65m²	Silicone rubber
Viruclear™ PNY Series	DS series	Nylon	Syringe filter	PP	3.4cm²	——
	Pilot scale	Nylon	Single-use Plastic-housing Capsule	PP	0.025/0.12/0.3m²	Silicone
	Production scale	Nylon	Single-use Plastic-housing Capsule	PP	0.6/1.2/1.8m²	Silicone
Viruclear™ PCE Series	DS series	PES	Syringe filter	PVDF	2.8cm²	PP
	Pilot scale	PES	Single-use Plastic-housing Cassette	PVDF	0.017/0.07/0.22m²	PP
	Production scale	PES	Single-use Plastic-housing Cassette	PVDF	0.5/1.5m²	PP
Viruclear™ PDT Series	DS series	Cellulose, diatomite, Nylon	Syringe filter	PP	4.5cm²	——
	Pilot scale	Cellulose, diatomite, Nylon	Single-use Plastic-housing Cassette Single-use Plastic-housing Cassette(M02)	PP PP/ GF	0.027/0.15/0.4m² 0.027/0.054m²	Silicone, PP
	Production scale	Cellulose, diatomite, Nylon	Single-use Plastic-housing Cassette Single-use Plastic-housing Cassette(M02)	PP PP/ GF	0.92/1.1m² 0.11/0.55/1.1m²	Silicone, PP
Viruclear™ PDS Series	DS series	Silicon dioxide, Composite fiber, Nylon	Syringe filter	Glass fiber reinforced polypropylene	4.5cm²	Silicone rubber
	Pilot scale	Silicon dioxide, Composite fiber, Nylon	Single-use Plastic-housing Cassette	Glass fiber reinforced polypropylene	0.027/0.054m²	Silicone rubber
	Production scale	Silicon dioxide, Composite fiber, Nylon	Single-use Plastic-housing Cassette(M02)	Glass fiber reinforced polypropylene	0.11/0.55/1.1m²	Silicone rubber

Ordering Information

Corevital™ SMDA Virus Removal Prefilter (PVDF Prefilter)

Bricap™ SFU Syringe Filters

□□□	□□	SMDA	□	□	P
Syringe filter	Connection Type	Filter Membrane Configuration	Sterilization	Quantity/Package	Market
U13 Filtration area 0.72cm²	**CP** Luer lock female inlet and Luer lock male outlet	**SMDA** SMDA 0.2/0.1μm	**G** Gamma Compatible	**1** 1pcs / pk	**P** Biopharmaceutical
U25 Filtration area 3.4cm²					
U33 Filtration area 4.5cm²					

Bricap™ C Series Capsule Filter

□	□□□	□	SMDA	□	□	□
Housing type	Syringe filter	Inlet/Outlet type	Filter Membrane Configuration	Sterilization	Quantity/Package	Product category
Blank Normal	**C01** Filtration area 180cm²	**T** 19mm(3/4")Sanitary flange	**SMDA** SMDA 0.2/0.1μm	**A** Autoclavable only	**1** 1pcs / pk	**Blank** Standard
K Transparent	**C02** Filtration area 420cm²	**K** 14mm(9/16")Sanitary flange		**G** Gamma Compatible		**Q**
	C03 Filtration area 660cm²	**F** 31mm(11/4")Sanitary flange		**S** Sterile		**P**
				C Sterile packaging with sterilizing breather bag		Market
						P Biopharmaceutical

Bricap™ L Series Capsule Filter

□	□□	□	SMDA	□	□	□
Housing type	Syringe filter	Inlet/Outlet type	Filter Membrane Configuration	Sterilization	Quantity/Package	Product category
Blank Normal	**L02** Filtration area 0.12m²	**S** 38mm(11/2")Sanitary flange	**SMDA** SMDA 0.2/0.1μm	**A** Autoclavable only	**1** 1pcs / pk	**Blank** Standard
K Transparent	**L03** Filtration area 0.16m²	**T** 19mm(3/4")Sanitary flange		**G** Gamma Compatible		**Q**
	L05 Filtration area 0.28m²	**K** 14mm(9/16")Sanitary flange		**S** Sterile		**P**
	L10 Filtration area 0.55m²			**C** Sterile packaging with sterilizing breather bag		Market
	L20 Filtration area 1.1m²					**P** Biopharmaceutical
	L30 Filtration area 1.65m²					

Ordering Information

Viruclear™ PNY Virus Removal Prefilter (Nylon Filter)

V P	N Y	□□	□□	P
Application	Material of Membrane	Type	Quantity/Package	Market
VP Viruclear PNY	**NY** Nylon	**DS** Syringe filter (3.4cm^2)	**N9** Only for syringe filter, 9pcs / pk **N1** 1pcs / pk	**P** Biopharmaceutical

Viruclear™ PNY Virus Removal Prefilter (Nylon Filter)

V P	N Y	□□□	□□	□□	P
Application	Material of Membrane	Type	Type	Quantity/Package	Market
VP Viruclear PNY	**NY** Nylon	**C02** 250cm^2 **L02** 0.12m^2 **L05** 0.30m^2	**TT** 3/4" TC	**N1** 1pcs / pk	**P** Biopharmaceutical

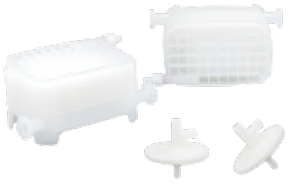
Viruclear™ PNY Virus Removal Prefilter (Nylon Filter)

V P	N Y	□□□	□□	□□	P
Application	Material of Membrane	Type	Type	Quantity/Package	Market
VP Viruclear PNY	**NY** Nylon	**L10** 0.60m^2 **L20** 1.20m^2 **L30** 1.80m^2	**SS** 1.5" TC	**N1** 1pcs / pk	**P** Biopharmaceutical

Ordering Information

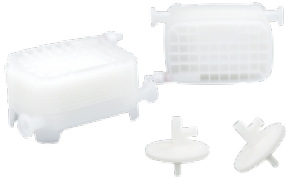
Viruclear™ PCE Virus Removal Prefilter with Plastic Shell

V P	C E	□□	□□	P
Application	Material of Membrane	Type	Quantity/Package	Market
VP Viruclear PDF	CE Cation Exchange PES Membrane	DC Syringe filter (2.8cm²)	N9 9pcs / pk N1 1pcs / pk	P Biopharmaceutical



Viruclear™ PCE Virus Removal Prefilter with Plastic Shell

V P	C E	□□	□□□	□□	P
Application	Material of Membrane	Type	Type	Quantity/Package	Market
VP Viruclear PDF	CE Cation Exchange PES Membrane	LA Lab(0.017m² & 0.007m²) FL Flow(0.22m² & 0.5m² & 1.5m²)	002 0.017m² 008 0.007m² 026 0.22m² 050 0.5m² 150 1.5m²	N1 1pcs / pk	P Biopharmaceutical



Viruclear™ PDS Virus Removal Prefilter

V P	D S	□□	□□	P
Application	Material of Membrane	Type	Quantity/Package	Market
VP Viruclear PDF	DS Depth filter	DS Syringe filter (4.5cm²) 27 M02(0.027m²) 54 M02(0.054m²) M1 M02(0.11m²) M5 M02(0.55m²) MX M02(1.1m²)	N9 9pcs / pk N1 1pcs / pk	P Biopharmaceutical

Ordering Information

Viruclear™ PDT Virus Removal Prefilter (Depth Filter)

V P	D T	□□	□□	P
Application	Material of Membrane	Type	Quantity/Package	Market
VP Viruclear PDT	**DT** Depth filter	**DS** Syringe filter (4.5cm^2)	**N9** Only for syringe filter, 9pcs / pk **N1** 1pcs / pk	**P** Biopharmaceutical

Viruclear™ PDT Virus Removal Prefilter (Depth Filter)

V P	D T	□□	□□	P
Application	Material of Membrane	Type	Quantity/Package	Market
VP Viruclear PDT	**DT** Depth filter	**L4** L08TT(0.027m^2) **SA** CSCD(0.15m^2) **SC** CSCE(0.4m^2) **27** M02(0.027m^2) **54** M02(0.054m^2)	**N9** 9pcs / pk **N1** 1pcs / pk	**P** Biopharmaceutical

Viruclear™ PDT Virus Removal Prefilter (Depth Filter)

V P	D T	□□	□□	P
Application	Material of Membrane	Type	Quantity/Package	Market
VP Viruclear PDT	**DT** Depth filter	**SB** CSCB(0.92m^2) **M1** M02 Cassette(0.11m^2) **M5** M02 Cassette(0.55m^2) **MX** M02 Cassette(1.1m^2)	**N1** 1pcs / pk	**P** Biopharmaceutical

Ordering Information

Viruclear™ VF Virus Removal Syringe Filters with PVDF Shell

V F	E	S	□□	□□	P
Application	Material of Membrane	Configuration Code	Type	Quantity/Package	Market
VF Virus filtration	**E** PES	**S** Standard	**DC** Syringe filter (2.8cm²)	**N9** Only for syringe filter, 9pcs / pk (3 batchs, 3 pcs per batch) **N1** 1pcs / pk	**P** Biopharmaceutical

Viruclear™ VF Removal Plastic-housing Cassette

V F	E	S	□□	□□□	□□	P
Application	Material of Membrane	Configuration Code	Type	Type	Quantity/ Package	Market
VF Virus filtration	**E** PES	**S** Standard	**LA** Lab (0.017/0.07m²) **FL** Flow (0.22/0.50/1.50m²)	**002** 0.017m² **008** 0.07m² **026** 0.22m² **050** 0.50m² **150** 1.50m²	**N1** 1pcs / pk	**P** Biopharmaceutical

Ordering Information

Viruclear™ VF Plus Virus Removal Syringe Filters with PVDF Shell

V F	P	E S	□□	□□	P
Application		Material of Membrane	Type	Quantity/Package	Market
VF Virus filtration	**P** Plus	**ES** mPES, hydrophilic modified PES membrane	**DC** Syringe filter (2.8cm²)	**N9** Only for syringe filter, 9pcs / pk (3 batchs, 3 pcs per batch) **N1** 1pcs / pk	**P** Biopharmaceutical

Viruclear™ VF Plus Removal Plastic-housing Cassette

V F	P	E	S	□□	□□□	□□	P
Application		Material of Membrane	Configuration Code	Type	Type	Quantity/ Package	Market
VF Virus filtration	**P** Plus	**E** mPES, hydrophilic modified PES membrane	**S** Standard	**LA** Lab (0.017/0.07m²) **FL** Flow (0.22/0.50/1.50m²)	**002** 0.017m² **008** 0.07m² **026** 0.22m² **050** 0.50m² **150** 1.50m²	**N1** 1pcs / pk	**P** Biopharmaceutical

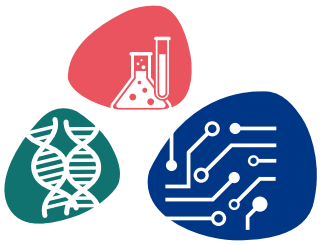
Ordering Information

Viruclear™ VF Plus X Virus Removal Syringe Filters with PVDF Shell

V F	X	E S	□□	□□	P
Application		Material of Membrane	Type	Quantity/Package	Market
VF Virus filtration	**X** Plus X	**ES** mPES, hydrophilic modified PES membrane	**DC** Syringe filter (2.8cm^2)	**N9** Only for syringe filter, 9pcs / pk (3 batchs, 3 pcs per batch) **N1** 1pcs / pk	**P** Biopharmaceutical

Viruclear™ VF Plus X Removal Plastic-housing Cassette

V F	X	E	S	□□	□□□	□□	P
Application		Material of Membrane	Configuration Code	Type	Type	Quantity/ Package	Market
VF Virus filtration	**X** Plus X	**E** mPES, hydrophilic modified PES membrane	**S** Standard	**LA** Lab (0.017/0.07m^2) **FL** Flow (0.22/0.50/1.50m^2)	**002** 0.017m^2 **008** 0.07m^2 **026** 0.22m^2 **050** 0.50m^2 **150** 1.50m^2	**N1** 1pcs / pk	**P** Biopharmaceutical



Filtration
Separation
Purification

cobetter®
filtration

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