Corning® Filtration Guide

Innovative Products for Filtration and Ultrafiltration

CORNING

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Selecting the Best Filter for Your Application

Choosing a filter does not have to be complicated – Corning has simplified the process. Just follow these four easy steps:

Step 1: Match your application with the appropriate pore size.

Step 2: Select the membrane and housing material for your application.

Step 3: Select the correct membrane area to optimize flow rate and throughput.

Step 4: Choose the best filter design for your application.

Step 1: Match your application with the pore size.

The pore size is usually determined by your application or objective. Mycoplasma removal can be performed using a 0.1 µm pore filter. Routine laboratory sterilization of most media, buffers, biological fluids and gases is usually done with 0.2 or 0.22 µm pore filter membranes. Clarification and prefiltration of solutions and solvents is best accomplished with 0.45 µm or larger filter membranes. Prefiltration to improve filter performance can also be accomplished by the use of glass fiber prefilters that can be purchased separately. Use Table 1 to match your applications with a recommended membrane and pore size.

Table 1. Selecting the Pore Size

Application	Pore Size (µm)	Membrane Availability
Mycoplasma Removal	0.1	PES
Sterilization and Ultracleaning of Aqueous Solutions	0.20 to 0.22	All membranes except PTFE
Ultracleaning of Solvents (HPLC)	0.20 to 0.22	RC, nylon, and PTFE
Clarification of Aqueous Solutions	0.45	All membranes except PTFE
Clarification of Solvents (HPLC)	0.45	RC, nylon, and PTFE
Coarse Particle Removal	0.8	SFCA, glass fiber prefilters

PES = polyethersulfone, PTFE = polytetrafluorethylene; RC = regenerated cellulose; SFCA = surfactant-free cellulose acetate.

Step 2: Select the membrane and housing material for your application.

Corning Filter Membranes

Your filter unit must be fully compatible with the chemical characteristics of your sample. Some filter membranes contain non-toxic wetting agents that may interfere with some applications. Other membranes may bind proteins or other macromolecules leading to premature filter clogging or loss of valuable samples. Therefore, it is very important to understand their characteristics and the potential effects filter membranes can have on the solutions they contact.

The information from Tables 2 and 3 will help you choose the appropriate Corning® membranes for your applications.

Table 2. Characteristics of Corning Filter Membranes

Membrane Material	Cellulose Nitrate	Cellulose Acetate	Nylon	Polyether-sulfone	Regenerated Cellulose	PTFE
Wetting Agents	Yes	Yes	No, naturally hydrophilic	No	Yes	Does not wet
Protein Binding	Very high	Very low	Low to moderate	Very low	Low	N/A
DNA Binding	High	Very low	Very high	Very low	Low	N/A
Chemical Resistance	Low	Low	Moderate to high	Low	Very high	Very high

PTFE = polytetrafluorethylene.

Cellulose acetate (CA) membranes have a very low binding affinity for most macromolecules and are especially recommended for applications requiring low protein binding, such as filtering culture media containing sera. However, both cellulose acetate and cellulose nitrate membranes are naturally hydrophobic and have small amounts (less than 1%) of non-toxic wetting agents added during manufacture to ensure proper wetting of the membrane. If desired, these agents can be easily removed prior to use by filtering a small amount of warm purified water through the membrane or filter unit. Surfactant-free cellulose acetate membranes with very low levels of extractables are available on some Corning® syringe filters.

Cellulose nitrate (CN) membranes are recommended for filtering solutions where protein binding is not a concern. They are recommended for use in general laboratory applications such as buffer filtration. Corning's cellulose nitrate membranes are Triton™ X-100-free and noncytotoxic.

Nylon membranes are naturally hydrophilic and are recommended for applications requiring very low extractables since they do not contain any wetting agents, detergents or surfactants. Their greater chemical resistance makes them better for filtering more aggressive solutions, such as alcohols and DMSO. However, like cellulose nitrate membranes, they may bind greater amounts of proteins and other macromolecules than do the cellulose acetate or PES membranes. They are recommended for filtering protein-free culture media.

Polyethersulfone (PES) membranes are recommended for filtering cell culture media. PES has both very low protein binding and extractables. PES also demonstrates faster flow rates than cellulosic or nylon membranes.

Regenerated cellulose (RC) membranes are hydrophilic and have very good chemical resistance to solvents, including DMSO. They are used to ultraclean and de-gas solvents and mobile phases used in HPLC applications.

Polytetrafluorethylene (PTFE) membranes are naturally and permanently hydrophobic. They are ideal for filtering gases, including humidified air. The extreme chemical resistance of PTFE membranes makes them very useful for filtering solvents or other aggressive chemicals for which other membranes are unsuitable. Because of their hydrophobicity, PTFE membranes must be prewetted with a solvent, such as ethanol, before aqueous solutions can be filtered.

Glass fiber filters are used as a depth filter for prefiltration of solutions. They have very high particle loading capacity and are ideal for prefiltering dirty solutions and difficult-to-filter biological fluids, such as sera.

Corning Filter Housing Materials

The filter housing materials, as well as the filter membrane must be compatible with the solutions being filters.

Polystyrene (PS) is used in the filter funnels and storage bottles for the Corning plastic vacuum filters. This plastic polymer should only be used in filtering and storing nonaggressive aqueous solutions and biological fluids. Refer to Table 3 for more chemical compatibility information.

Acrylic copolymer (AC) and **Polyvinyl chloride (PVC)** are used in some of the Corning syringe filter housings. These plastics should only be used in filtering nonaggressive aqueous solutions and biological fluids. Refer to Table 3 for more chemical compatibility information.

Polypropylene (PP) is used in the Spin-X® centrifuge filters and some of the syringe and disc filter housings. This plastic polymer has very good resistance to many solvents, refer to Table 3 for more chemical compatibility information.

Chemical Compatibility

The mechanical strength, color, appearance, and dimensional stability of Corning® filters are affected to varying degrees by the chemicals with which they come into contact. Specific operating conditions, especially temperature and length of exposure, will also affect their chemical resistance. Table 3 provides a general guideline for the chemical resistance of Corning filter membranes and housings.

Table 3. Chemical Resistance Guide for Corning Filters*

	Filter Membrane						Housing Material			
Chemical Class	**CN**	**CA**	**NY**	**PES**	**RC**	**PTFE**	**PS**	**PP**	**AC**	**PYR**
Weak Acids	2	2	2	1	1	1	1	1	2	1
Strong Acids	3	3	3	1	3	1	2	1	3	2
Alcohols	3	1	1	1	1	1	2	1	3	1
Aldehydes	2	3	2	3	2	1	3	1	3	1
Aliphatic Amines	3	3	1	1	1	1	3	1	3	1
Aromatic Amines	3	3	2	3	1	1	3	1	3	1
Bases	3	3	2	1	2	1	1	1	2	2
Esters	3	3	1	3	1	1	3	2	2	1
Hydrocarbons	2	2	2	3	1	1	3	2	2	1
Ketones	3	3	2	3	1	1	3	2	3	1

1 = Recommended; 2 = May be suitable for some applications, a trial run is recommended; 3 = Not recommended;
AC = acrylic copolymer; CA = cellulose acetate; CN = cellulose nitrate; NY = nylon; PES = polyethersulfone; PP = polypropylene;
PS = polystyrene; PTFE = polytetrafluorethylene; PVC = polyvinylchlorides; PYR = PYREX® glass; RC = regenerated cellulose.

*This information has been developed from a combination of laboratory tests, technical publications, or material suppliers. Due to conditions outside of Corning's control, such as variability in temperatures, concentrations, duration of exposure and storage conditions, no warranty is given or is to be implied with respect to this information.

Step 3: Select the correct membrane area to optimize flow rate and throughput.

Select a filter that will have enough volume capacity or throughput to process your entire sample quickly and efficiently. This is primarily determined by the effective surface area of the membrane. Table 4 shows the relationship between filter size, effective filtration surface area and expected throughput volumes. The lower values are typical of viscous or particle-laden solutions; the higher values are typical of buffers or serum-free medium.

Table 4. Typical Expected Throughput Volumes

Filter Diameter/Dimension and Description	Effective Filter Area (cm^2)	Expected Throughput (mL)*
4 mm syringe/disc	0.07	0.05-3
15 mm syringe/disc	1.7	3-15
25 mm syringe/disc	4.8	10-50
26 mm syringe/disc	5.3	10-50
28 mm syringe/disc	6.2	10-50
50 mm disc	19.6	100-500
42 mm vacuum system/square	13.6	100-500
49.5 mm vacuum system/square	19.6	200-750
63 mm vacuum system/square	33.2	300-1500
79 mm vacuum system/square	54.5	500-3000

*These values assume an aqueous solution and a 0.2 micron membrane. Solutions containing sera or other proteinaceous materials
will be at the lower end of the range. Use of prefilters may extend the throughput 50 to 100% above the values shown.

Step 4: Choose the filter design for your application.

Corning offers three basic filter types: positive pressure-driven syringe and disc filters, Spin-X® centrifuge tube filters driven by centrifugation, and vacuum-driven filters. The vacuum-driven filters offer several different designs and styles in disposable plastic products.

Syringe/Disc Filters

Syringe filters

The smaller conventional **Corning® syringe disc-type filters** (4, 15, 25, 26, and 28 mm diameter) are used with syringes which serves as both the fluid reservoir and the pressure source. They are 100% integrity tested. The HPLC-certified non-sterile syringe filters are available with nylon, regenerated cellulose or polytetrafluorethylene (PTFE) membranes in polypropylene housing for extra chemical resistance. The sterile tissue culture tested syringe filters are available in PES, regenerated cellulose (ideal for use with DMSO-containing solutions), or surfactant-free cellulose acetate membranes in either polypropylene or acrylic copolymer housings.

The larger **50 mm diameter disc filter** has a PTFE membrane and polypropylene housing with hose barb connectors. This product is ideal for filtering aggressive solvents or gases and applications requiring sterile venting of gases. Because they have a hydrophobic (will not pass aqueous solutions) membrane, they are also ideal for protecting vacuum lines and pumps.

Corning Disposable Plastic Vacuum Filters

Filter/storage systems

These sterile filters are available in three styles: complete filter/storage systems, bottle top filters and centrifuge tube top filters. Corning filters feature printed funnels that identify membrane type and product number for easy product identification. Angled hose connectors simplify vacuum line attachment. Four membranes are available to meet all of your filtration needs: cellulose acetate, cellulose nitrate, nylon, or polyethersulfone.

Corning filter/storage systems consist of a polystyrene filter funnel joined by an adapter ring to a removable polystyrene storage bottle with a separate sterile polyethylene cap. Receiver bottles feature easy grip sides for improved handling. Additional Corning polystyrene receiver/storage bottles can be ordered separately to increase throughput.

Corning bottle top filters have the same polystyrene filter funnel designs and capacities as the filter systems, but the adapter ring is designed for threading onto a glass bottle supplied by the user. Select either the 33 mm thread design for standard narrow glass mouth media bottles or the 45 mm design for PYREX® or PYREXPLUS® media bottles. See Safety Precautions for recommendations on using these products with glass bottles (page 7).

150 mL centrifuge tube top filters feature a 150 mL polystyrene filter funnel with a 50 mm diameter cellulose acetate membrane attached to a 50 mL polypropylene centrifuge tube to minimize unnecessary transfers by filtering directly into centrifuge tube.

Spin-X Centrifuge Tube Filters

Spin-X centrifuge tube filters

Spin-X centrifuge tube filters consist of a membrane-containing (either cellulose acetate or nylon) filter unit within a polypropylene centrifuge tube. They filter small sample volumes by centrifugation for bacteria removal, particle removal, HPLC sample preparation, removal of cells from media and purification of DNA from agarose and polyacrylamide gels (see page 6).

Improving Filter Performance

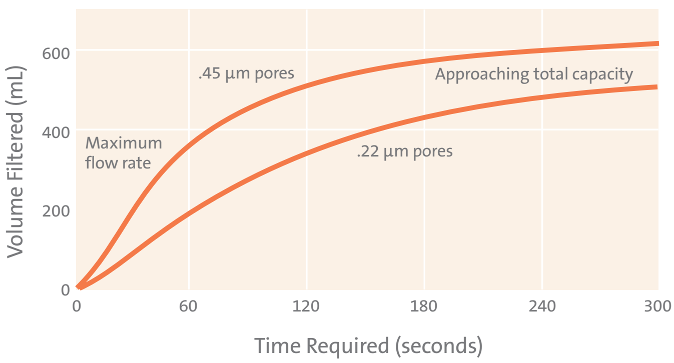
Getting the best performance from your filtration products requires two very important steps: selecting the right products for the job, and then using these products effectively. The first part of this brochure covered the steps required to select the right filter for your applications; this section will help you optimize the filtration process by keying on the two most important areas – maximizing filter flow rate and throughput or capacity.

The flow rate and throughput of filters are dependent on many variables. Some variables, such as temperature, pressure, and especially, the characteristics of the sample, require special attention.

Effect of Pore Size

The pore size of filter membranes is usually dictated by the requirements of the filter application rather than the desired flow rate. Larger pore membranes usually have both faster flow rates and greater capacity before pore clogging slows the flow. Figure 1 indicates the effect of pore size on filter performance. As expected, the initial flow rate (steep part of the curve) of the .45 µm filter was approximately twice that of the .22 µm filter, although its capacity or throughput prior to clogging (the area at the plateau) was only about 20% greater.

Figure 1. Effect of Size on Performance



Test Conditions: Medium containing 10% fetal bovine serum was filtered using cellulose acetate membranes at 23°C and 600 mm Hg vacuum.

Table 5. Corning Filter Designs

Design	Sterile	Filter Diameters/ Dimensions (mm)	Available Membrane Material	Pore Size (µm)	Special Features
Syringe Filters	Some	4, 15, 25, 26, 28	RC, PES, SFCA, NY, PTFE	0.2, 0.45, 0.8 (SFCA only)	Ideal for small volume pressure filtration
Disc Filters	Yes	50	PTFE	0.2	Ideal for filtering solvents and gases
Vacuum Filter Systems*	Yes	42, 49.5, 63, 79	PES, CA, CN, NY	0.1 (PES only), 0.2 (NY only), 0.22 (PES, CA, CN), 0.45 (CA only)	Easy grip bottles for storing filtrate
Bottle Top Vacuum Filters*	Yes	42, 63, 79	PES, CA, NY	0.2 (NY only), 0.22 (PES, CA), 0.45 (CA only)	Two neck widths to fit most glass bottles
Tube Top Vacuum Filters*	Yes	42	CA	0.22, 0.45	Minimizes unnecessary transfers by filtering into a 50 mL centrifuge tube
Spin-X® Centrifuge Filters	Some	7.7	CA, NY	0.22, 0.45	Ideal for purifying DNA from agarose gels

CA = cellulose acetate; CN = cellulose nitrate; NY = Nylon; PES = polyethersulfone; PTFE = polytetrafluorethylene; RC = regenerated cellulose; SFCA = surfactant-free cellulose acetate.
*Vacuum filter systems, bottle top vacuum filters, and tube top vacuum filters have a square membrane.

Effect of Membrane Area

The easiest and most practical way to increase filter flow rate is to increase the effective surface area of the filter membrane. Corning offers both syringe and vacuum filter units with a choice of membrane diameters that give a wide range of flow rates and throughputs (see Table 4).

Effect of Fluid Temperature

For most applications, filtering solutions at room temperature is fine. Usually increasing the temperature of a solution will increase the flow rate. For example, increasing the temperature of cell culture medium from 4°C to 37°C resulted in a doubling of the flow rate. This is most likely due to a decrease in the viscosity of the medium. In some cases, however, filtration at lower temperatures may increase the overall throughput, especially with protein and lipid-containing solutions such as serum.

Effect of Pressure Differential

For vacuum-driven filtration, a pressure differential (vacuum) of 400 mm Hg (7.73 psig) is recommended. Increasing the pressure differential further will slightly increase the flow rate, but it may also result in excess foaming as the gases in the filtrate come out of solution as bubbles. This is especially a problem with filtering bicarbonate-buffered cell culture media. The dissolved carbon dioxide in the medium will evolve quickly at higher-pressure differentials leading to a rise in pH and excessive foaming if serum proteins are present.

Spin-X® Tube Purification of DNA from Agarose Gels

Purification of DNA from an agarose gel with the Spin-X tube is quick and efficient, unlike the electroelution, dialysis, and "freeze-squeeze" methods. The Spin-X method consists of two simple steps: excision of the band from the gel and centrifugation in the Spin-X tube. Yields range from 30 to 80%.

Protocol*

1. Electrophorese DNA in an agarose gel containing ethidium bromide.
2. After electrophoresis, illuminate the gel under long wavelength UV light, then, using a sharp instrument, carefully excise the band of interest (30-15,000 bp).
3. Place the gel slice into the filter cup of the Spin-X tube (Cat. Nos. 8160, 8161, 8162, 8163) and mix with 100 to 200 µL of distilled water or Tris-EDTA.
4. Spin the tube at about 13,000 x g for 5 to 20 minutes at room temperature.
5. Collect the DNA from the microcentrifuge tube; the agarose gel will be retained on the Spin-X membrane. If needed, ethanol precipitate the DNA to remove any EDTA present.

NOTE: DNA yield may increase with the incorporation of one or all of the following steps:

1. Macerate the gel slice prior to placement in the Spin-X tube.
2. Prior to centrifugation in Step 4 freeze the gel slice at -70°C in a separate tube, then allow to thaw.
3. After the initial centrifugation, add an additional 200 µL of buffer to the Spin-X tube and centrifuge again.
4. Spin for a longer period of time.

*Schwarz, Herbert and Whitton, J. Lindsay, 1992. A Rapid, Inexpensive Method for Eluting DNA from Agarose or Acrylamide Gel Slices Without Using Toxic or Chaotropic Materials. Vol. 13, No. 2, Biotechniques.

Effect of Prefiltration

A simple way to improve filter performance is to pretreat your solution. High speed centrifugation will remove most suspended particles and reduce filter clogging, extending both flow rate and throughput (Corning® 250 and 500 mL centrifuge bottles are ideal for centrifuging larger liquid volumes). Prefiltration through a glass fiber pad or depth filter will also reduce particle load and premature membrane clogging. The use of a glass fiber prefilter has been demonstrated to more than double the throughput when filtering calf serum. These glass fiber prefilters are available for all Corning vacuum filter systems and bottle top filters. For particularly difficult to filter solutions, it may be helpful to first prefilter the solution through a larger pore membrane filter.

Safety Precautions

Corning filter units are intended for use by persons knowledgeable in safe laboratory practices. Safety is one of the most critical concerns of any lab. Because of variations in conditions, Corning cannot guarantee any glassware or plasticware against breakage under vacuum or pressure. Failure can result from surface damage, improper pressure or temperature, or use with incompatible chemicals. Adequate precautions should always be taken to protect personnel doing such work. To help improve lab safety, Corning has compiled these common-sense suggestions concerning the safe use of filtration products:

- Use of vacuum-driven filters on glass or plastic bottles may cause personal injury if they implode during use. Eye protection is strongly recommended whenever glass or plastic vessels are used under partial vacuum negative pressure to guard against these injuries. Only bottles specifically designed for these applications should be used.
- Never use the 45 mm threaded bottle top filters on PYREX® or PYREXPLUS® media bottles larger than 2 liter capacity or that are square. Use of bottle top filters with PYREXPLUS media bottles (with plastic safety coatings) is highly recommended for vacuum filtration.
- Never use the 33 mm threaded bottle top filters on standard glass media bottles that are larger than 500 mL or on bottles that are not cylindrical.
- Never use plastic roller bottles as substitute receiver bottles during vacuum filtration.
- Do not use a bottle for vacuum applications if it is not designed to withstand a vacuum; if the bottle is scratched, chipped or cracked; if the bottle is clamped in such a way as to induce stress; or if the bottle is being hand-held.
- Care must be taken when using syringe filters with small syringes (5 mL or less) as the pressures generated may exceed the 75 psi limit, causing a possible membrane or housing failure. Loss of valuable contents and personal injury may result. If clogging causes slower flow rates, we recommend that you replace filters rather than increase the pressure.

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Brock, TS. Membrane Filtration: A User's Guide and Reference Manual. Science Tech, Inc. Madison, WI, 1983.

Lukaszewicz, RC and Fisher, R. Mechanisms of Membrane Filtration for Particulate and Microbial Retention in Critical Applications. Pharmaceutical Technology, Vol. 5: June 1981.

Walsh, RL and Coles, ME. Binding of IgG and other Proteins to Microfilters. Clin. Chem. 26(3):496-498, 1981.

Ordering Information

Syringe Filters

- A variety of membranes are available to meet your needs: polyethersulfone (PES) – low protein binding and faster flow rates; surfactant-free cellulose acetate (SFCA) – lowest protein binding; polytetrafluorethylene (PTFE) – chemical resistance; regenerated cellulose (RC) – best choice for DMSO compatibility; nylon (NY) – hydrophilic, surfactant-free and lowest extractable.
- 100% integrity tested, nonpyrogenic and noncytotoxic

Cat. No.	Diameter (mm)	Pore Size (µm)	Membrane Material	Housing Material	Sterile	Inlet/ Outlet	Packaging	Qty/ Cs
431212	4	0.2	RC	PP	Yes	LL/LS	Indiv.	50
431215	15	0.2	RC	PP	Yes	LL/LS	Indiv.	50
431218	28	0.2	SFCA-PF	AC	Yes	LL/LS	Indiv.	50
431219	28	0.2	SFCA	AC	Yes	LL/LS	Indiv.	50
431220	28	0.45	SFCA	AC	Yes	LL/LS	Indiv.	50
431221	28	0.8	SFCA	AC	Yes	LL/LS	Indiv.	50
431222	25	0.2	RC	PP	Yes	LL/LS	Indiv.	50
431224	25	0.2	NY	PP	Yes	LL/LS	Indiv.	50
431225	25	0.45	NY	PP	Yes	LL/LS	Indiv.	50
431227*	50	0.2	PTFE	PP	Yes	HB/HB	Indiv.	12
431229	28	0.2	PES	AC	Yes	LL/LS	Indiv.	50
431231	25	0.45	PTFE	PP	No	LL/LS	Bulk	50

AC = acrylic copolymer; HB = hose barb; LL = Luer lock/female; LS = Luer slip/male; NY = nylon; PES = polyethersulfone; PP = polypropylene; PTFE = polytetrafluorethylene; RC = regenerated cellulose; SFCA = surfactant-free cellulose acetate.
*Recommended as in-line air filter.

Spin-X® Centrifuge Tube Filters

- Spin-X centrifuge tube filters consist of a membrane-containing filter unit within a microcentrifuge tube.
- Uses:
  - Removing bacteria, cells, and particles from liquids
  - HPLC sample preparation
  - DNA removal from agarose or acrylamide gels.
  - Maximum RCF (Relative Centrifugal Force [x g]) is 16,000.

Cat. No.	Membrane Material	Working Volume (µL)	Pore Size (µm)	Sterile	Tube Size (mL)	Qty/Cs
8160	CA	500	0.22	Yes	2.0	96
8161	CA	500	0.22	No	2.0	100
8162	CA	500	0.45	Yes	2.0	96
8163	CA	500	0.45	No	2.0	100
8169	NY	500	0.22	No	2.0	200
8170	NY	500	0.45	No	2.0	200

CA = cellulose acetate, NY = nylon.

150 mL Tube Top Vacuum Filters

- 42 mm square membrane
- Minimizes unnecessary transfers by filtering directly into a 50 mL centrifuge tube
- Includes two centrifuge tube stands with each case
- Each polypropylene centrifuge tube is supplied with an individually wrapped cap for storage
- Individually packaged, sterile, nonpyrogenic

Cat. No.	Membrane	Funnel Size/ Tube Size (mL)	Pore Size (µm)	Qty/Cs
430314	CA	150/50	0.45	12
430320	CA	150/50	0.22	12

CA = cellulose acetate.

Vacuum Filter Systems

- Four sizes: 150 mL, 250 mL, 500 mL and 1L
- Filters feature printing on the funnel for easy product identification.
- Angled hose connector simplifies vacuum line attachment.
- Receiver bottles feature easy grip sides for improved handling.
- Individually packaged, sterile, nonpyrogenic
- Caps for receiver bottles are sterile and individually packaged.
- Extra plastic storage bottles are available, see Page 11.
- Prefilters not included

Cat. No.	Membrane	Funnel/Bottle Volume (mL)	Pore Size (µm)	Qty/Cs
150 mL Capacity, 42 mm Square Membrane				
431153	PES	150/150	0.22	12
431154	CA	150/150	0.22	12
431155	CA	150/150	0.45	12
250 mL Capacity, 49.5 mm Square Membrane				
430756	CN	250/250	0.22	12
430767	CA	250/250	0.22	12
430768	CA	250/250	0.45	12
430771	NY	250/250	0.2	12
431096	PES	250/250	0.22	12
500 mL Capacity, 63 mm Square Membrane				
430758	CN	500/500	0.22	12
430769	CA	500/500	0.22	12
430770	CA	500/500	0.45	12
430773	NY	500/500	0.2	12
431097	PES	500/500	0.22	12
431475	PES	500/500	0.1	12
1,000 mL Capacity, 79 mm Square Membrane				
430186	CN	1,000/1,000	0.22	12
430515	NY	1,000/1,000	0.2	12
430516	CA	1,000/1,000	0.45	12
430517	CA	1,000/1,000	0.22	12
431098	PES	1,000/1,000	0.22	12
431205*	CA	500/1,000	0.22	12
431206*	CA	500/1,000	0.45	12
431474	PES	1,000/1,000	0.1	12

*500 mL funnel with 63 mm membrane.
CA = cellulose acetate; CN = cellulose nitrate; NY = nylon; PES = polyethersulfone.

Bottle Top Vacuum Filters

- Individually packaged, sterile and nonpyrogenic
- Available in 33 mm and 45 mm neck sizes to fit most glass and plastic media storage bottles
- 45 mm neck sizes fit on Corning® plastic storage bottles (see below).

Cat. No.	Membrane	Volume (mL)	Neck Size (mm)	Pore Size (µm)	Qty/Cs
150 mL Capacity, 42 mm Square Membrane					
430624	CA	150	33	0.22	48
430625	CA	150	33	0.45	48
430626	CA	150	45	0.22	48
430627	CA	150	45	0.45	48
431160	PES	150	33	0.22	48
431161	PES	150	45	0.22	48
500 mL Capacity, 63 mm Square Membrane					
430049	NY	500	45	0.2	12
430512	CA	500	33	0.45	12
430513	CA	500	45	0.22	12
430514	CA	500	45	0.45	12
430521	CA	500	33	0.22	12
431117	PES	500	33	0.22	12
431118	PES	500	45	0.22	12
1,000 mL Capacity, 79 mm Square Membrane					
430015	CA	1,000	45	0.22	12
431174	PES	1,000	45	0.22	12

CA = cellulose acetate; CN = cellulose nitrate; NY = nylon; PES = polyethersulfone.

Glass Fiber Prefilters

- For use with vacuum filter systems or bottle top vacuum filters

Cat. No.	Shape	Filter Funnel (mL)	Qty/Cs
431410	42 mm Square	150	100
431411	49.5 mm Square	250	100
431412	63 mm Square	500	100
431413	79 mm Square	1000	100

Polystyrene Storage Bottles

- Disposable polystyrene bottles for storage of media, buffers and other aqueous solutions
- Two styles:
  - Low profile, easy grip style has sides that facilitate handling
  - Traditional style has smooth sides
- Plug seal caps (45 mm) provide an airtight seal and help minimize the risk of contamination.
- Bottles can be used with Corning® vacuum filter systems (see pages 9-10).
- Sterile, nonpyrogenic

Corning Easy Grip Style Storage Bottles

Cat. No.	Volume (mL)	Neck Size (mm)	Qty/Pk	Qty/Cs
431175	150	45	2	24
430281	250	45	2	24
430282	500	45	2	24
430518	1,000	45	2	24

Costar® Traditional Style Storage Bottles

Cat. No.	Volume (mL)	Neck Size (mm)	Qty/Pk	Qty/Cs
8388	125	45	1	24
8390	250	45	1	12
8393	500	45	1	12
8396	1,000	45	1	12

Introduction

Spin-X® UF concentrators are disposable, single use only ultrafiltration devices with polyethersulfone membranes (PES) for the centrifugal concentration and/or purification of biological samples. This guide will help you chose the best Spin-X UF concentrator for your application.

Major Uses for Ultrafiltration

Ultrafiltration is a convective process that uses anisotropic semi-permeable membranes to separate macromolecular species and solvents primarily on the basis of size. It is particularly appropriate for the concentration of macromolecules and can also be used to purify molecular species or for solvent exchange (Table 1). Ultrafiltration is a gentle, non-denaturing method that is more efficient and flexible than alternative processes.

Solute Concentration

Ultrafiltration membranes are used to increase the solute concentration of a desired biological species. The filtrate is cleared of macromolecules which are significantly larger than the retentive membrane pores. Microsolute is removed convectively with the solvent.

Solute Desalting or Purification

A solution may be purified from salts, non-aqueous solvents and generally from low molecular weight materials. Multiple solvent exchanges will progressively purify macromolecules from contaminating solutes. Microsolutes are removed most efficiently by adding solvent to the solution being ultrafiltered at a rate equal to the speed of filtration. This is called diafiltration.

Choosing the Right Concentrator Doesn't Have to be Complicated

Corning offers Spin-X UF concentrators in three sizes. The information below and Tables 2 and 3 will help you find the best concentrator for your needs.

1. Spin-X UF 500 for 100 to 500 µL samples

Spin-X UF 500 µL concentrators offer a simple, one-step procedure for sample preparation. They can effectively be used in fixed-angle rotors accepting 2.2 mL centrifuge tubes.

The vertical membrane design and thin channel filtration chamber minimizes membrane fouling and provides high speed concentrations, even with particle laden solutions.

2. Spin-X UF 6 for 2 to 6 mL samples

Spin-X UF 6 mL concentrators offer increased volume flexibility and performance. Spin-X UF 6 concentrators can process up to 6 mL in swing bucket or fixed-angle rotors accepting standard 15 mL conical bottom tubes. In a single spin, solutions can be concentrated in excess of 100-fold. Samples are typically concentrated in 10 to 30 minutes with macromolecular recoveries in excess of 95%.

The Spin-X UF 6 features twin vertical membranes for 100X plus concentrations. Remaining volume is easy to read off the printed scale on the side of the concentrator, and the modified dead stop pocket further simplifies direct pipet recovery of the final concentrate.

3. Spin-X® UF 20 for 5 to 20 mL samples

Spin-X UF 20 mL concentrators offer increased volume flexibility and performance. Spin-X UF 20 handles up to 20 mL in swing bucket centrifuges and 14 mL in 25° fixed-angle rotors accepting 50 mL centrifuge tubes.

Featuring twin vertical membranes, the Spin-X UF 20 can achieve 100X plus concentrations. The remaining volume is easy to read off the printed scale on the side of the concentrator, and the modified dead stop pocket further simplifies direct pipet recovery of the final concentrate.

Table 1. Typical Ultrafiltration Applications

- General purpose laboratory concentration and desalting of proteins, enzymes, cells, biomolecules, antibodies and immunoglobulins
- Removal of labeled amino acids and nucleotides
- HPLC sample preparation
- Deproteinization of samples
- Recovery of biomolecules from cell culture supernatants, lysates

Table 2. Technical Properties of Spin-X UF Concentrators

Concentrator	Spin-X UF 500	Spin-X UF 6	Spin-X UF 20
Concentrator Capacity			
Swing bucket rotor	Do not use	6 mL	20 mL
Fixed angle rotor	500 µL	6 mL	14 mL
Minimum rotor angle	40°	25°	25°
Dimensions			
Total Length	50 mm	122 mm	116 mm
Width	11 mm	17 mm	30 mm
Active membrane area	0.5 cm^2	2.5 cm^2	6.0 cm^2
Membrane hold up volume	<5 µL	<10 µL	<20 µL
Dead stop volume*	5 µL	30 µL	50 µL
Materials of Construction			
Body	Polycarbonate	Polycarbonate	Polycarbonate
Filtrate vessel	Polypropylene	Polycarbonate	Polycarbonate
Concentrator cap	Polycarbonate	Polypropylene	Polypropylene
Membrane	Polyethersulfone	Polyethersulfone	Polyethersulfone

*Dead stop volume as designed in molding tool. This volume may vary depending on sample, sample concentration, operation temperature, and centrifuge rotor.

Table 3. PES Membrane Selection Guide (Recommended MWCO*)

Application	<5,000	10,000	30,000	50,000	100,000
Bacteria					■
Enzymes	■	■			
Growth factors	■	■			
Immunoglobulins			■	■	■
MAB			■	■	■
Peptides	■		■	■	
Virus			■	■	■
Yeast					■

*For highest recovery, select a membrane MWCO which is at least half of the molecular weight of the solute to be retained.

Choosing the Appropriate Molecular Weight Cut-off (MWCO) Membrane

Spin-X® UF concentrators use general purpose polyethersulfone membranes that provide excellent performance with most solutions when retentate recovery is of primary importance. Polyethersulfone membranes exhibit no hydrophobic or hydrophilic interactions and are usually preferred for their low fouling characteristics, exceptional flux and broad pH range.

The advanced designs and low adsorption materials that characterize Spin-X UF products offer a unique combination of faster processing speeds and higher recovery of the concentrated sample. Providing that the appropriate device size (Table 2) and membrane cut-off (Table 3) are selected, Spin-X UF products will typically yield recoveries of the concentrated sample in excess of 90% when the starting sample contains over 0.1 mg/mL of the solute of interest (Table 4). Most of the loss is caused by nonspecific binding both to the membrane surface and to exposed binding sites on the plastic of the sample container.

Adsorption to the Membrane

Depending on sample characteristics relative to the membrane type used, solute adsorption on the membrane surface is typically 2 to 10 µg/cm². This can increase to 20 to 100 µg/cm² when the filtrate is of interest and the solute must pass through the whole internal structure of the membrane. Typically, a higher cut-off membrane will bind more than a low molecular weight cut-off membrane.

Adsorption to the Sample Container

Although every effort is made to minimize this phenomenon by the selection of low adsorption materials and tool production to optical standards, some solute will bind to the internal surface of the sample container. While the relative adsorption will be proportionately less important on the sample container than on the membrane due to the higher total surface area, this can be the major source of yield loss.

Table 4. Spin-X UF Concentrators Performance Characteristics
(Time in minutes to concentrate up to 30X at 20°C and solute recovery %)

Concentrator	Spin-X UF 500		Spin-X UF 6				Spin-X UF 20			
Rotor	40° Fixed Angle		Swing Bucket		25° Fixed Angle		Swing Bucket		25° Fixed Angle	
Start volume mL	500 µL		6 mL		6 mL		20 mL		14	
	Min.	Rec.	Min.	Rec.	Min.	Rec.	Min.	Rec.	Min.	Rec.
BSA 1.0 mg/mL (66,000 MW)										
5,000 MWCO PES	15	96%	20	98%	12	98%	23	99%	29	99%
10,000 MWCO PES	5	96%	13	98%	10	98%	16	98%	17	98%
30,000 MWCO PES	5	96%	12	98%	9	97%	13	98%	15	98%
IgG 0.25 mg/mL (160,000 MW)										
30,000 MWCO PES	10	96%	18	96%	15	95%	27	97%	20	95%
50,000 MWCO PES	10	96%	17	96%	14	95%	27	96%	22	95%
100,000 MWCO PES	10	96%	15	91%	12	91%	25	91%	20	90%

Helpful Hints

Flow Rate

Flow rate is affected by several parameters, including MWCO, porosity, sample concentration, viscosity, centrifugal force, and temperature. Expect significantly longer spin times for starting solutions with over 5% solids. When operating at 4°C, flow rates are approximately 1.5 times slower than at 25°C. Viscous solutions such as 50% glycerin will take up to 5 times longer to concentrate than samples in a predominantly buffer solution.

Pre-rinsing

Membranes fitted to Spin-X® UF concentrators contain trace amounts of glycerin and sodium azide. Should these interfere with analysis, they can be removed by rinsing fill volume of buffer solution or deionized water through the concentrator. Decant filtrate and concentrate before processing sample solution. If you do not want to use the prerinsed device immediately, store it in the refrigerator with buffer or water covering the membrane surface. Do not allow the membrane to dry out.

Sterilization of Polyethersulfone Membranes

Polyethersulfone membranes should not be autoclaved as high temperatures will substantially increase membrane MWCO. To sanitize or sterilize these devices, use a 70% ethanol solution or sterilizing gas mixture.

Optimizing Solute Recovery

When highest solute recoveries are most important, in particular when working with solute quantities in the microgram range, Corning recommends considering the following key points:

- Select the smallest device that suits the sample volume. Additionally, take advantage of the extra speed of Spin-X UF concentrators by refilling a smaller concentrator repeatedly.
- Select the lowest MWCO membrane that suits the application.
- When available, use swing bucket rotors rather than fixed angle rotors. This reduces the surface area of the concentrator that will be exposed to the solution during centrifugation.
- Reduce centrifugal force to approximately half of the maximum recommended (Table 5).
- Avoid over-concentration. The smaller the final concentrate volume, the more difficult it is to achieve complete recovery. If feasible, after a first recovery, rinse the device with one or more drops of buffer and then recover again.
- Pre-treat the device overnight with a passivation solution such as 5% SDS, TWEEN® 20, or Triton™ X in distilled water. Then, rinse thoroughly before use.

Table 5. Maximum Recommended Centrifugal Force

Concentrator	Spin-X UF 500	Spin-X UF 6	Spin-X UF 20
Maximum Spin Force – Swing Bucket			
5,000 to 50,000 MWCO PES	Do not use	4,000 xg	4,000 xg
>100,000 MWCO PES	Do not use	4,000 xg	3,000 xg
Maximum Spin Force – Fixed Angle			
5,000 to 50,000 MWCO PES	12,000 xg	8,000 xg	6,000 xg
>100,000 MWCO PES	12,000 xg	6,000 xg	6,000 xg

Chemical Compatibility

Spin-X UF concentrators are designed for use with biological fluids and aqueous solutions. For chemical compatibility details, refer to Table 6.

Table 6. Chemical Compatibility*
(2 hour contact time; compatible pH range, pH 1-9)

Acetic Acid (25.0%)	1	Lactic Acid (5.0%)	1
Acetone (10.0%)	3	Mercaptoethanol (10 mL)	1
Acetonitrile (10.0%)	3	Methanol (60%)	2
Ammonium Hydroxide (5.0%)	2	Nitric Acid (10.0%)	1
Ammonium Sulphate (saturated)	1	Phenol (1.0%)	2
Benzene (100%)	3	Phosphate Buffer (1.0 M)	1
n-Butanol (70%)	1	Polyethylene Glycol (10%)	1
Chloroform (1.0%)	3	Pyridine (100%)	2
Dimethyl Formamide (10.0%)	2	Sodium Carbonate (20%)	2
Dimethyl Sulfoxide (5.0%)	1	Sodium Deoxycholate (5.0%)	1
Ethanol (70.0%)	1	Sodium Dodecyl sulfate (0.1 M)	1
Ethyl Acetate (100%)	3	Sodium Hydroxide	3
Formaldehyde (30%)	1	Sodium Hypochlorite (200 ppm)	2
Formic Acid (5.0%)	1	Sodium Nitrate (1.0%)	1
Glycerine (70%)	1	Sulfamic Acid (5.0%)	1
Guanidine HCl (6 M)	1	Tetrahydrofuran (5.0%)	3
Hydrocarbons, aromatic	3	Toluene (1.0%)	3
Hydrocarbons, chlorinated	3	Trifluoroacetic Acid (10%)	1
Hydrochloric Acid (1 M)	1	TWEEN® 20 (0.1%)	1
Imidazole (500 mM)	1	Triton™ X-100 (0.1%)	1
Isopropanol (70%)	1	Urea (8 M)	1

*1 = acceptable, 2 = questionable, testing advised, 3 = not recommended.
This information has been developed from a combination of laboratory tests, technical publications, or material suppliers.

Ordering Information

Spin-X® UF Concentrators

Spin-X UF centrifugal concentrators offer a simple, one-step procedure for concentrating or desalting proteins and other biomolecules with 90% or better recovery.

Features and Benefits

- The vertical membrane design and thin channel filtration chamber minimizes membrane fouling and provides fast, high-speed concentrating, even with particle-laden solutions.
- Integrated dead stop design reduces risk of spinning to dryness; no respinning necessary
- Choice of three sizes for greater flexibility:
  - Spin-X UF 500 for samples up to 500 µL
  - Spin-X UF 6 for samples up to 6 mL
  - Spin-X UF 20 for samples up to 20 mL, 14 mL if using fixed-angle rotors
- Low binding polyethersulfone (PES) membranes are available with five molecular weight cut-offs (MWCO): 5,000, 10,000, 30,000, 50,000 and 100,000 to meet all of your concentrating needs. Choose an MWCO 1/2 to 1/3 smaller than the protein to be concentrated.
- The MWCO and graduations are printed right on the side of the concentrator tube to avoid mix-ups.

Spin-X UF 6 and 20 concentrators can be used with either swinging bucket or fixed-angle rotors. Spin-X UF 500 concentrators require fixed-angle rotors.

A size to fit all your concentrating needs

Spin-X UF 500

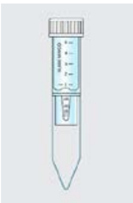
Spin-X UF 6

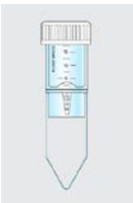
Spin-X UF 20

Spin-X® UF Applications

- Concentration, desalting of proteins, enzymes, monoclonal antibodies, immunoglobulins
- Removal of labeled amino acids and nucleotides
- HPLC sample preparation
- Deproteinization of samples
- Recovery of biomolecules from cell culture supernatants, lysates
- Concentrating virus from cell culture supernatants

Spin-X UF Concentrators





Cat. No.	Description	Capacity	Membrane	Pack Size
Spin-X UF 500				
431477	Spin-X UF 500	500 µL	5,000 MWCO	25
431478	Spin-X UF 500	500 µL	10,000 MWCO	25
431479	Spin-X UF 500	500 µL	30,000 MWCO	25
431480	Spin-X UF 500	500 µL	50,000 MWCO	25
431481	Spin-X UF 500	500 µL	100,000 MWCO	25
Spin-X UF 6				
431482	Spin-X UF 6	6 mL	5,000 MWCO	25
431483	Spin-X UF 6	6 mL	10,000 MWCO	25
431484	Spin-X UF 6	6 mL	30,000 MWCO	25
431485	Spin-X UF 6	6 mL	50,000 MWCO	25
431486	Spin-X UF 6	6 mL	100,000 MWCO	25
Spin-X UF 20				
431487	Spin-X UF 20	20 mL	5,000 MWCO	12
431488	Spin-X UF 20	20 mL	10,000 MWCO	12
431489	Spin-X UF 20	20 mL	30,000 MWCO	12
431490	Spin-X UF 20	20 mL	50,000 MWCO	12
431491	Spin-X UF 20	20 mL	100,000 MWCO	12

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