

Laboratory Ultrafiltration How to Choose the Optimal Device & Method A Qualification Guide to Aid Device Selection Based on Sample Characteristics


This guide below is designed to help research and process development scientists select the best Sartorius ultrafiltration product for each application. It focuses on the three critical aspects of selection: target molecule type, target size and sample volume, to highlight the most suitable product ranges. Various treatments, process controls and application examples are also provided. This guide is based upon typical ultrafiltration models and selected data. Due to the variations within protein, membrane and inorganic chemistry, we always recommend establishing the most suitable device for your application as part of a robust process optimization strategy.

How to use this guide:

Sample Characteristic

Guidance includes information on the **membrane angle, material and MWCO**, the **products available**, and **process methods and controls**.

Some typical recommendations are also provided, based on application testing and data.

Target Type	Proteins (neutral or negatively charged) Membranes: Vertical PES, RC or CTA Products Available: Vivaspin® 500, 2, 6, 15R, 20, 100 Vivaspin® Turbo 4, 15 Vivaflow® 50, 200	Proteins (positively charged) Membranes: Vertical HY or RC Products Available: Vivaspin® 2, Filtrate Vivaspin® Turbo 15 Vivaflow® 50R, 200 Vivacon® 500, 2	Viruses Membranes: Vertical HY, PES or RC Products Available: Vivaspin® 500, 2, 6, 15R, 20, 100 Vivaspin® Turbo 4, 15 Vivaflow® 50, 50R, 200	Extracellular Vesicles Membranes: Vertical HY, PES or RC Products Available: Vivaspin® 500, 2, 6, 15R, 20, 100 Vivaspin® Turbo 4, 15 Vivaflow® 50, 50R, 200	Nucleic Acids Membranes: Horizontal HY or CTA Products Available: Vivaspin® Filtrate Vivacon® 500, 2	Inorganics Membranes: Vertical HY, PES or RC Products Available: Vivaspin® 500, 2, 6, 15R, 20, 100 Vivaspin® Turbo 4, 15 Vivaflow® 50, 50R, 200
Target Size*	<10 kDa MCWOs: 2 or 3 kDa Products Available: Vivaspin® 500, 2, 6, 15R, 20 Vivaspin® Turbo 4, 15 Vivaflow® 50, 200 Vivacon® 500, 2	10–30 kDa MCWOs: 3 or 5 kDa Products Available: Vivaspin® 500, 2, 6, 15R, 20, 100 Vivaspin® Filtrate, Turbo 4, 15 Vivaflow® 50, 50R, 200	30–150 kDa MCWOs: 10, 20, 30 or 50 kDa Products Available: Vivaspin® 500, 2, 6, 15R, 20, 100 Vivaspin® Filtrate, Turbo 4, 15 Vivaflow® 50, 50R, 200 Vivacon® 500, 2	150–500 kDa MCWOs: 50, 100 or 125 kDa Products Available: Vivaspin® 500, 2, 6, 20, 100 Vivaspin® Filtrate, Turbo 4, 15 Vivaflow® 50, 50R, 200 Vivacon® 500, 2	500–1000 kDa MCWOs: 100, 125 or 300 kDa Products Available: Vivaspin® 500, 2, 6, 20, 100 Vivaspin® Filtrate, Turbo 4, 15 Vivaflow® 50, 50R, 200 Vivacon® 500, 2	>1000 kDa MCWOs: 300 or 1,000 kDa, 0.2 µm Products Available: Vivaspin® 500, 2, 6, 20, 100 Vivaspin® Filtrate Vivaflow® 50, 200
Sample Volume	0.1–2.5 mL  Process Method: Centrifuge Products Available: Vivaspin® 500, 2, Filtrate Vivacon® 500, 2	2.5–20 mL  Process Method: Centrifuge, pressure or pressure-fuge Products Available: Vivaspin® 6, 15R, 20, Filtrate Vivaspin® Turbo 4, 15	20–100 mL  Process Method: Centrifuge, pressure or pressure-shake Products Available: Vivaspin®100	100 - 5,000  Process Method: Crossflow Products Available: Vivaflow® 50, 50R, 200		
Treatment and Control	Buffer Exchange Key Points: Replacing the original buffer or desalting a sample to, e.g., ensure target molecule stability by preventing precipitation. Diafiltration allows for simultaneous buffer exchange and concentration Process Control: Diafiltration available to all products, especially with Vivaspin® 20 diafiltration cups and Vivaflow® diafiltration reservoir . Application Note: <input checked="" type="checkbox"/>	Low Concentrations Key Points: Samples with low concentrations rely on near 100% recovery, preventing non-specific adsorption is key for this Process Control: Passivation by rinsing with non-interfering protein and buffer solutions (e.g. BSA, Tween 20, SDS). Available to all products . Application Note: <input checked="" type="checkbox"/>	Depyrogenation Key Points: Removal of endotoxins (lipopolysaccharides) from devices before sample concentration. Process Control: NaOH treatment prior to concentration and buffer exchange. Available in products resistant to NaOH; Vivaspin® Turbo 4 and 15, Vivaflow® 50R and 200 Application Note: <input checked="" type="checkbox"/>	Device Sanitization Key Points: Reduction of bioburden and contaminating microbes. Level of reduction to be determined by user testing. Process Control: Pre-rinse with 70% ethanol or apply an EtO gas treatment process. Available to all products excluding Vivaspin® 100 and Vivaflow® (separate cleaning processes) Application Note: TBA	Final Volume Key Points: Varying speeds of concentration make it hard to judge time to reach the desired final volume. Process Control: Pre-filling the filtrate tube limits the maximum concentration factor, thereby defining the final concentrated volume. Available to Vivaspin® 500, Vivaspin® Turbo 4 and 15 Application Note: <input checked="" type="checkbox"/>	Sensitive Samples Key Points: Changing transmembrane pressures can result in varied shear stresses, degrading sensitive target molecules. Process Method: Pressurization and TFF provide more stable transmembrane pressure and flux compared to centrifugation. Available in Vivaspin® 100 and Vivaflow® Application Note: <input checked="" type="checkbox"/>
Example Applications	1. Monoclonal Antibodies Application: Concentration for purification Target: IgG1, IgG2a, IgG2b, IgG3 Target Size: 160 kDa Sample Volume: 3 L Product Used: Vivaflow® 200, 30 kDa MWCO PES Process Control: Pre-rinsing with 2 L DI water to remove storage buffer and perform integrity check. Result: 98% recovery from 3 L Hybridoma cell culture supernatant concentrated 10-fold, from 30 to >300 mg/L, with an average flux of 20 - 25 mL/min (2 hour total processing time).	2. Extracellular Vesicles Application: Concentration and purification of EVs Target: Exosomes, microvesicles, apoptotic bodies Target Size: 50 - 5,000 nm Sample Volume: 2 mL Product Used: Vivaspin® 2, 6, Turbo 4 or Filtrate, 10 kDa MWCO PES, HY or CTA Process Method: Device benchmarking for optimal concentration of EVs from cell culture media. Results: 7 to 9-fold conc. factor in ≤ 8 min. Highest recovery and purity of EVs with mean particle size of 150 nm (NTA) was observed when using Vivaspin® 2 with 10 kDa MWCO PES membranes.	3. Lentivirus Application: Polishing after AEX chromatography Target Type: Lentiviral vector Target Size: ~100 nm Sample Volume: 20 mL Product Used: Vivaspin® 20, 100 kDa MWCO PES Process Control: Parallel desalting and concentration with diafiltration cup Results: 78 to 143-fold concentrations of 20 mL samples within 34–40 minutes, increasing particle concentration from 6.1 × 10 ⁷ to 3.0 × 10 ⁹ per mL after purification.	4. DNA PCR Primers Application: Concentration and purification of DNA Target: dsDNA Target Size: 300 bp Sample Volume: 1.8 mL Product Used: Vivacon® 2, 30 kDa MWCO HY Process Control: Separation of amplified DNA from PCR primers. Results: Near total removal (>95%) of primers and near total retention and recovery of 300 bp target DNA, within a 20 minute spin time and a total 40 minute procedure time.		