

Laboratory Ultrafiltration How to Choose the Optimal Ultrafilter

A Qualification Guide Based on Sample Characteristics and Case Studies




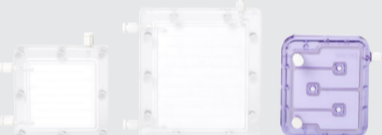
This guide is intended to assist research scientists in selecting the optimal ultrafilter for each ultrafiltration | diafiltration application. It provides product recommendations based on three key factors: the type and size of the target molecule, and the sample volume. Exemplary case study data are also provided for selected macromolecule types.

The recommendations are derived from typical performance data, and variations may occur due to specific sample characteristics and process conditions. Therefore, identification of the appropriate ultrafilter is essential as part of a comprehensive process optimization strategy.

How to use this guide:

Sample Characteristic

Guidance covers **feed flow direction, membrane materials and MWCOs, available products, process methods and controls, and techniques for optimization.**

Target Type	Proteins (neutral or negatively charged) Feed Flow: Tangential Membranes: CTA, PES or RC Products Available: Vivaspin® 500, 2, 6, 15R, 20, 100 Vivaspin® Turbo 4, 15 Vivaflow® SU, 50R, 200	Proteins (positively charged) Feed Flow: Tangential Membranes: RC Products Available: Vivaspin® 2, 15R Vivaspin® Turbo 15 Vivaflow® SU, 50R, 200	Viruses Feed Flow: Tangential Membranes: PES or RC Products Available: Vivaspin® 500, 2, 6, 15R, 20, 100 Vivaspin® Turbo 4, 15 Vivaflow® SU, 50R, 200	Extracellular Vesicles Feed Flow: Tangential Membranes: PES or RC Products Available: Vivaspin® 500, 2, 6, 15R, 20, 100 Vivaspin® Turbo 4, 15 Vivaflow® SU, 50R, 200	Nucleic Acids Feed Flow: Normal or Tangential Membranes: CA or RC Products Available: Vivaspin® Filtrate Vivaspin® 500, 2 Vivacon® 500, 2 Vivaflow® SU, 50R, 200	Inorganics Feed Flow: Tangential Membranes: PES or RC Products Available: Vivaspin® Filtrate Vivaspin® 500, 2, 6, 15R, 20, 100 Vivaspin® Turbo 4, 15 Vivaflow® SU, 50R, 200
	Target Size*	<10 kDa MWCOs: 2 or 3 kDa Products Available: Vivaspin® 500, 2, 6, 15R, 20 Vivaspin® Turbo 4, 15 Vivaflow® SU, 200 Vivacon® 500, 2	10 – 30 kDa MWCOs: 3 or 5 kDa Products Available: Vivaspin® 500, 2, 6, 15R, 20, 100 Vivaspin® Filtrate, Turbo 4, 15 Vivaflow® SU, 50R, 200	30 – 150 kDa MWCOs: 10, 20, 30 or 50 kDa Products Available: Vivaspin® 500, 2, 6, 15R, 20, 100 Vivaspin® Filtrate, Turbo 4, 15 Vivaflow® SU, 50R, 200 Vivacon® 500, 2	150 – 500 kDa MWCOs: 50, 100 or 125 kDa Products Available: Vivaspin® 500, 2, 6, 20, 100 Vivaspin® Filtrate, Turbo 4, 15 Vivaflow® SU, 50R, 200 Vivacon® 500, 2	500 - 1,000 kDa MWCOs: 100, 125 or 300 kDa Products Available: Vivaspin® 500, 2, 6, 20, 100 Vivaspin® Filtrate, Turbo 4, 15 Vivaflow® SU, 50R, 200 Vivacon® 500, 2
Sample Volume	0.1–2.5 mL  Process Method: Centrifuge Products Available: Vivaspin® 500, 2, 6, Filtrate, Turbo 4 Vivacon® 500, 2	2.5–20 mL  Process Method: Centrifuge, pressure or pressure-fuge Products Available: Vivaspin® 6, 15R, 20 Vivaspin® Turbo 4, 15	20–100 mL  Process Method: Centrifuge, pressure or pressure-shake Products Available: Vivaspin®100	100 - 5,000 mL  Process Method: TFF (crossflow) Products Available: Vivaflow® SU, 50R, 200		
	Process Controls Optimization	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 the Vivaflow® 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"/>
Case Studies	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 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 PES, RC 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 PES membranes.	3. Lentiviral Vectors Application: Polishing after AEX chromatography Target Type: Lentiviral vector Target Size: ~100 nm Sample Volume: 20 mL Product Used: Vivaspin® 20, 100 kDa 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. 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 RC 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.		