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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
Vivacon® 500, 2
Vivaflow® SU, 50R, 200

Inorganics

Feed Flow:
Tangential
Membranes:
PES or RC
Products Available:
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

>1,000 kDa

MWCOs:
300 or 1,000 kDa, 0.2 µm
Products Available:
Vivaspin® 500, 6, 20, 100
Vivaspin® Filtrate
Vivaflow® SU, 200
Vivacon® 2

Sample Volume

0.1 – 2.5 mL

Process Method:
Centrifuge
Products Available:
Vivaspin® 500, 2, 6, Filtrate, Turbo 4
Vivacon® 500, 2

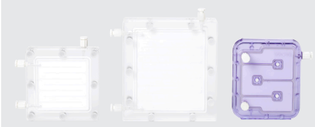
2.5 – 20 mL

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: ☑

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: ☑

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: ☑

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: ☑

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: ☑

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.

Find further details of all tips, tricks, applications and products at:
www.sartorius.com/products/lab-filtration-purification/ultrafiltration-devices

*If the size of your target molecule is not expressed in kDa, please refer to our conversion table to determine the recommended MWCO.