

Laboratory Ultrafiltration How to Choose the Optimal Device & Method

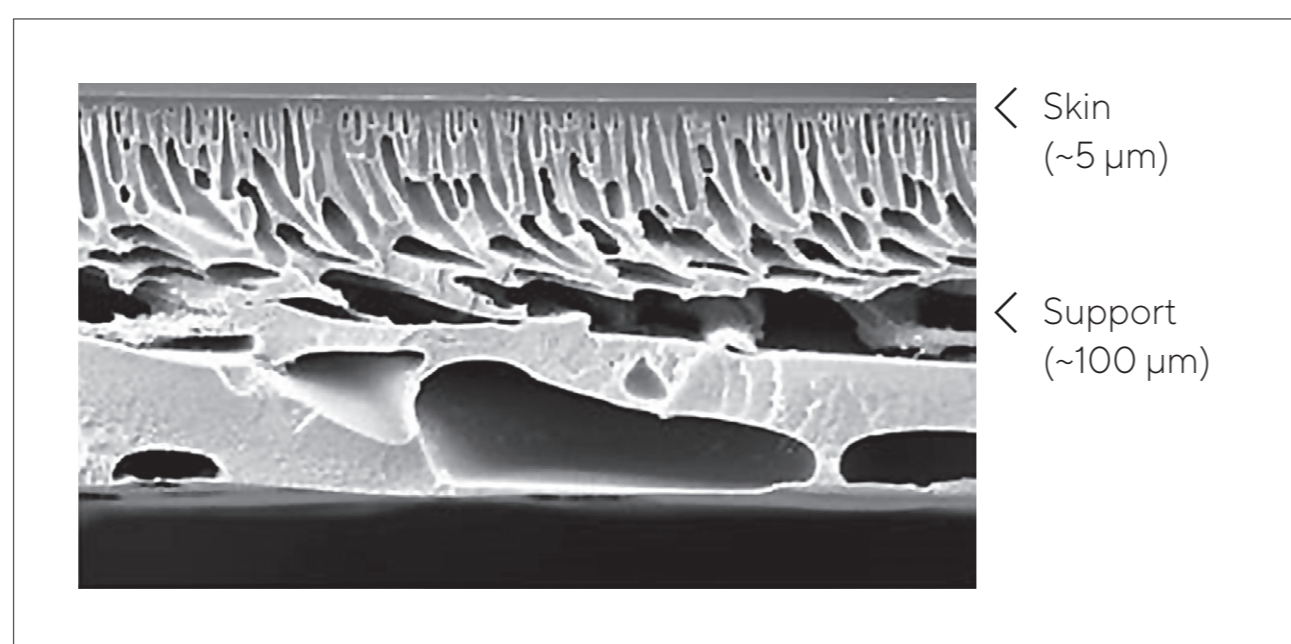
A Selection Guide for Proteins, Viruses, Nucleic Acids, Exosomes, Nanoparticles, Polymers and More

1. Consider Sample | Molecular Properties

Molecule shape	Linear molecules concentrate best at lower relative centrifugal forces
pH and salt conditions	Sample composition may cause aggregation and conformational changes
Temperature	Lower processing temperatures reduce the rate of concentration
Sample fractionation	Can only be achieved with a 10-fold difference in molecular weight
Aggregation and rearrangement	May affect size distribution of the target molecule
Non-specific binding	Test multiple membrane materials for each target molecule, to maximize recovery

Ultrafilter cross section SEM
Showing the membrane skin and separate membrane support

- Membrane Options:**
1. Cellulose Triacetate (CTA)
 2. Polyethersulfone (PES)
 3. Regenerated Cellulose (RC)
 4. Hydrosart® (HY)



2. Select the Right Device



Vivaspin® Filtrate
0.1 – 2.5 mL
Higher binding, good for protein removal



Vivaspin® 500, 6 and 20
0.1 – 20 mL
High membrane surface areas, simultaneous buffer exchange, pressure, or pressure-fugation with VS 20, good for core applications



Vivaspin® 2
0.4 – 3 mL
Reverse spin enabled, good for low concentrations



Vivaspin® Turbo
2 – 15 mL
Fastest concentrations, angular dead-stops, good for recovery



Vivaspin® 100
20 – 100 mL
Centrifuge or pressure driven, good for mid range volumes



Vivaflow®
100 – 5,000 mL
Plug and play crossflow cassettes, good for quick, simple, concentration of larger volumes



Vivacon®
0.1 – 2 mL
PCR grade available, good for dilute samples and DNA targets

3. Select the Right Molecular Weight Cut-Off (MWCO)

- MWCO should be 1/3 to 1/2 the target MW or size for optimal recovery of most macromolecules
- Lower MWCOs may increase recovery, but reduce ultrafiltration speed and retain low MW contaminants
- Higher MWCOs have larger pore sizes and higher surface areas, which may result in more non-specific binding and passage
- Use reverse spin enabled devices (e.g. Vivaspin® 2 or Vivacon® 500) for pipette-free sample retrieval to maximize recoveries

MWCO	Protein MW	Molecule Size	dsDNA Length	ssDNA Length	Estimated Pore Size
1,000 K	>3,000 kDa	300 – 600 nm	>5,000 bp	>9,000 sb	100 nm
300 K	900 – 1,800 kDa	90 – 200 nm	>1,500 bp	>2,900 sb	30 nm
100 K	300 – 900 kDa	30 – 90 nm	>600 bp	>900 sb	10 nm
50 K	150 – 300 kDa	15 – 30 nm	>300 bp	>475 sb	7 nm
30 K	90 – 180 kDa	9 – 15 nm	>50 bp	>275 sb	4 nm
10 K	30 – 90 kDa	5 – 9 nm	>30 bp	>90 sb	2.5 nm
5 K	15 – 30 kDa	3 – 5 nm	>20 bp	>50 sb	1.5 nm
3 K	10 – 20 kDa	2.5 – 3.6 nm	>15 bp	>30 sb	1.2 nm
2 K	3 – 10 kDa	2 – 3 nm	>10 bp	>10 sb	1 nm

4. Consider Device Pre-Treatment

- For low starting concentrations, pretreat devices with blocking solution to negate non-specific adsorption
- Pre-rinsing can be used to remove analytes, such as glycerin, that are used to ensure membrane stability – but devices must be used immediately after pre-rinsing, without allowing the membrane to dry out
- Flushing devices with 70% ethanol can be used to minimize the risk of sample contamination
- Vivaspin® devices can be sterilized using EtO gas, to further ensure against contamination

5. Choose the Best Process Control Method

- Buffer exchange can be performed in parallel to concentration by using diafiltration cups and reservoirs
- Retrieve the entire retentate easily, with angular dead-stop devices and the correct pipette tips
- Pre-define your final sample volumes by filling the filtrate vessel with water or buffer before concentration
- For sensitive targets try using pressurized devices to ensure stable flux and reduced shear stress
- Most lab ultrafiltration devices are intended for single use to ensure optimal performance

Did You Know?

- Sartorius offers free samples to support your testing and ensure you're always using the optimal device
- Sartorius offers diafiltration cups and pressure accessories for Vivaspin® 20 and 100
- For *in vitro* diagnostics (IVD) applications, you must use IVD registered devices
- Vivaspin® Turbo angular dead-stops simplify retrieval of every last microlitre of the retentate

