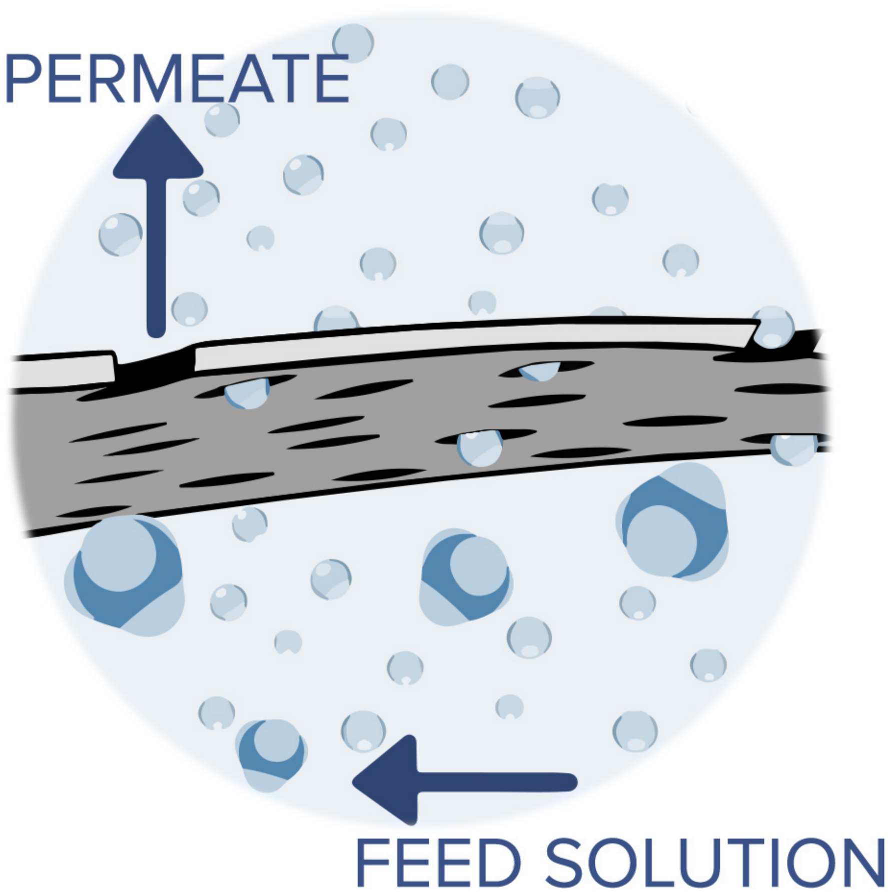
STERLITECH Corporation

CROSSFLOW FILTRATION HANDBOOK



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SECTION 1: BASIC PRINCIPLES OF CROSSFLOW FILTRATION

In crossflow filtration systems, feed streams flow tangentially over the surface of a membrane filter. Some of the feed stream will permeate through the membrane while the rest will continue to flow through the system as a concentrate. The tangential flow across the membrane reduces the fouling rate by increasing the back transport of fouling agents from the membrane surface, through inertial lift, surface drag, and shear diffusion mechanisms. The feed's tangential/cross flow also reduces the concentration polarization formed at the membrane surface, further reducing the membrane's fouling rate.

Sterlitech's bench-scale crossflow filtration systems provides users with a modular system compatible with a wide range of applications across an array of disciplines. It is designed to be versatile enough to meet the dynamic needs of researchers and engineers alike and is ideal for research and development, small batch processing, and simulating larger commercial processes.

SECTION 2: FREQUENTLY ASKED QUESTIONS

How is cross flow velocity calculated?
Cross flow velocity is calculated by dividing the volumetric flow rate through the cell by the cross section area of the cell.

What is the recommended range of cross flow velocity in commercially available spiral wound elements?
Cross flow velocity limits for commercially available spiral wound elements depend on the element construction limits, recommended maximum pressure drop in an element, and feed characteristics. The recommended values can be obtained form the manufacturers.

What is the recommended range of cross flow velocity in Sepa CF, CF042 or CF016 cell?
Cross flow velocity affects the hydrodynamic conditions in the system and therefore affects the rate of fouling. If the objective of the experiment is to mimic the hydrodynamic conditions in commercially available spiral wound elements it is recommended to stay in the range recommended by the manufactures. If the objective of the experiment is to shed light on the effect of cross flow velocity on the membrane performance/fouling, the optimum range of cross flow velocity should be identified experimentally. This can range between 0.05 m/s to 1 m/s. Please contact Sterlitech for more information.

The flat sheet membranes appear dry in their packaging. Do they need to be pre-wetted before use?
Yes, you need to pre-wet the membranes. The best procedure is to place them in a dry holder and allow them to wet from the inlet side first. It may be best to perform this operation with water or a buffer, then dispose of the first rinse, and introduce the process fluid. This prevents any wetting agents or preservatives from mixing with the process solution.

What is the recommended pre-conditioning procedure for flat sheet membranes?
Pre-conditioning procedure for flat sheet membranes depends on the type of the membranes and is generally provided by the membrane manufacturer. This could include filtering clean water or a mixture of water and alcohol though the membrane at test pressure until the permeate flux through the membrane reaches a quasi-steady state condition. Further information can be found in Section 5 (page 3).

How do I clean the membranes?
Determining which solution to use to clean a flat sheet membrane depends on the substance it is fouled with. As a general rule, you can use a caustic or oxidant solution for organic fouling and an acidic solution for inorganic causes. Please remember that different membranes polymers have different pH tolerances. Please contact Sterlitech for more information.

How are the membranes stored after use?
Most importantly, flat sheet membranes should be kept wet after use. Control biological growth by adding 0.5% solution of formaldehyde, sodium metabisulfite, or use deionized water and change it out at least once a week. If you use sodium metabisulfite we recommend changing it out every three months since it is a little weaker than formaldehyde.

Can the depth of the feed channel be changed?
Yes, a single shim or a combination of shims with several thickness options can be provided with each cell to change the depth of the feed channel.

What is the recommended maximum operating pressure and temperature for each cell?
Maximum pressure and temperature depends on the material the cell is made of. Please refer to the cell-specific operation manual.

SECTION 3: EXAMPLE CROSSFLOW STUDIES

The following studies utilized Sterlitech crossflow cells in their method and are listed here to illustrate the potential applications for crossflow filtration. These studies are good references for understanding the operation of Sterlitech's crossflow cells.

APPLICATION	STUDY CITATION
Reverse Osmosis (Desalination)	Sachit, Dawood Eisa. "Analysis of reverse osmosis membrane performance during desalination of simulated brackish surface waters." Journal of Membrane Science. 453. (2014): 136-154.
Forward Osmosis and Low Pressure Reverse Osmosis	Yangali-Quintanilla, Victor, Zhenyu Li, et al. "Indirect desalination of Red Sea water with forward osmosis and low pressure reverse osmosis for water reuse."Desalination. 280. (2011): 160-166.
Ultrafiltration (Food Processing)	Post, Antonie, Hanna Sampels, et al. "A comparison of micellar casein and β-casein as sources of basic peptides through tryptic hydrolysis and their enrichment using two-stage ultrafiltration."International Journal of Dairy Technology. 65.4 (2012): 482-489.
Ultrafiltration and Nanofiltration (Protein Production)	Ranamukhaarachi, Sahan, Lena Meissner, et al. "Production of antioxidant soy protein hydrolysates by sequential ultrafiltration and nanofiltration."Journal of Membrane Science. 429. (2013): 81-87.
Membrane Development	Qadir, Ahmad. Development of new membranes for desalination pre-treatment. MA thesis. University of Illinois at Urbana-Champaign, 2011. Web. <https://www.ideals.illinois.edu/handle/2142/26369>.

SECTION 4: CUTTING CUSTOM MEMBRANE FILTERS

Sterlitech offers a wide variety of RO/NF/UF/MF membranes that are available pre-cut for use with the Sepa CF, CF042 and CF016 Cells. However, if you need to cut your own membrane, you will need the following items:

- The template provided with the cell

  Note: *Sterlitech also offers steel rule dies (P/N: 1230006 for CF016 Die, CF042 Die, Sepa Die) that are designed to cut the membrane to the correct size and shape.*

- The membrane sheet to be cut
- A pair of sharp scissors
- A pair of latex gloves

To cut membrane filters for the Sepa CF, CF042 and CF016 Cells:

1. Take the provided template and place the membrane sheet against it. Be sure to have the latex gloves on to avoid contaminating the membrane surface.

2. Cut along the edge of the template with the scissors. Hold the scissors at an angle towards the center of the template to avoid under-trimming.

Once finished, the membrane should sit perfectly flat on supports without any bending and extend outside of the inner O-ring to avoid leakage.

SECTION 5: PRECONDITIONING MEMBRANES FOR USE

Membrane pre-conditioning procedure varies from one manufacturer to the other. If no instruction is provided by the manufacturer follow the instructions provided below. To pre-condition the membrane:

1. Load the membrane into the cross flow cell
2. Fill the feed tank with deionized water and pressurize the cell. The temperature of the water and the pressure used should be exactly the same as the temperature and pressure that will be used in the actual trials. If the temperature varies through the experiment, Equation 1 in Section 6 can be used to correct for the effect of temperature on the permeate flux.
3. Run the deionized water through the cell until the flux is relatively constant. Flux through the membrane will stabilize after a few minutes.
4. Release pressure, discard the deionized water and fill the cell with your sample.

SECTION 6: EFFECT OF TEMPERATURE ON PERMEATE FLUX

Permeate flux through the membrane is generally a function of temperature. Therefore, Equation 1 can be used to correct for the effect of temperature on the permeate flux.

$$J_0 = J\left(\frac{\mu}{\mu_0}\right) \qquad \text{Equation 1}$$

Where J_0 is the permeate flux at the reference temperature (e.g. 25°C), μ_0 is the viscosity at the reference temperature (e.g. 25°C), J is the permeate flux at the test temperature, and μ is the viscosity at the test temperature.

SECTION 7: MEMBRANE TEST LOG

System							Stage #				Housing #			
			Choose units	FEED			TDS CONCENTRATION			FLOW		PRESSURE		
				SDI	pH	Temp	Feed	Perm	Conc	Conc	Perm	Feed	Conc	Perm
Date	Time	Operator	UNITS:			°F / °C	ppm or mg/L	ppm or mg/L	ppm or mg/L	gpm	gpm	psig	psig	psig

Date	Time	Comments

SECTION 8: STERLITECH MEMBRANE PRODUCT LINES

The following tables list the membrane product lines offered by Sterlitech and the applications that they are most commonly used for. The technical information for these membranes follows in Section 9 (Page 10). This list is updated frequently; please visit our website (www.sterlitech.com) for latest updates.

REVERSE OSMOSIS MEMBRANES

DESIGNATION	APPLICATION
ACM1	"Tight" brackish water
ACM2	Standard brackish water
ACM3	Lower pressure brackish water
ACM4	Low pressure/high flux
ACM5	Low pressure/high flux
AG	Brackish Water Desalination, Reactive Silica Removal
AK	Low Pressure Brackish Water Desalination, Reactive Silica Removal
CE	Brackish Water Desalination
SB50	1 ppm continuous free chlorine tolerance, typically sized before sold in element form
SE	Acid Concentration, Antibiotic Concentration, Dyehouse Wastewater Reclamation, Evaporator Condensate, Fruit Juice Concentration, Laundry Wastewater Reclamation, Starch/Sugar Concentration
SG	Acid Concentration, Antibiotic Concentration, Dyehouse Wastewater Reclamation, Evaporator Condensate, Fruit Juice Concentration, Laundry Wastewater Reclamation, Starch/Sugar Concentration
X201	Low organic, colloidal, biological fouling
73AC	Brackish Water
73HA	Brackish Water
82V	Seawater Membrane- High Rejection, Low Energy
SW30HR	Sea Water (high rejection)
SW30XLE	Sea Water (extra low energy)
BW30	Brackish Water
BW30LE	Brackish Water (low energy)
BW30XFR	Brackish Water
XLE	Brackish Water (extra low energy)

NANOFILTRATION MEMBRANES

DESIGNATION	APPLICATION
CK	Water Softening
DK	Acid Purification, Alcohol Purification, Antibiotic Concentration, BOD/COD Reduction, Cheese Whey Desalting, Detergent Removal, Dextrose Purification, Dye Concentration, Ethylene Glycol Purification, Heavy Metal Removal, Plating Waste, Polysaccharide Desalting, Sugar Fractionation
DL	Acid Purification, Alcohol Purification, Antibiotic Concentration, BOD/COD Reduction, Cheese Whey Desalting, Detergent Removal, Dextrose Purification, Dye Concentration, Ethylene Glycol Purification, Heavy Metal Removal, Plating Waste, Polysaccharide Desalting, Sugar Fractionation
HL	Water Softening
DURACID	Acid Purification, Mineral Concentration
TS40	Process NF
TS80	Softening
SB90	Chlorine Resistant
XN45	Process NF
NF	High Rejection
NF270	Organics Removal, Softening
NF90	Low Energy, Low Pressure
NFX	Dye Penetrant Removal, Gibberellins
NFW	Softening
NFG	High Flux, Softening
NDX	NA
NP010	Acid/Caustic Preparation, Metal, Chemical
NP030	Acid/Caustic Preparation, Metal, Chemical

ULTRAFILTRATION MEMBRANES

DESIGNATION	APPLICATION
GH	Colloidal Iron Removal, Colloidal Silica Removal, Dye Purification, Organics Concentration, Organics Fractionations, Organics Purification, Protein Separation and Concentration, Quenchant Recovery
GK	Colloidal Iron Removal, Colloidal Silica Removal, Dye Purification, Organics Concentration, Organics Fractionations, Organics Purification, Protein Separation and Concentration, Quenchant Recovery
GE	Surface/chemicals
JW	Cell Harvesting, Lysate Clarification, Oil/Water Separations, RO/NF Pretreatment, Suspended Solids Removal
EW	Dextran Purification, Post Treatment of UltraPure Water

DESIGNATION	APPLICATION
PT	Enzyme Concentration, Post Treatment of UltraPure Water, Protein Separation and Concentration, PVA Concentration, Whey Concentration
MW	Cell Harvesting, Lysate Clarification, Oil/Water Separations
PW	Enzyme Concentration, Post Treatment of UltraPure Water, Protein Separation and Concentration, PVA Concentration, Whey Concentration
UA60	“Tight” thin film UF
UE50	100k “open” UF
XT	AB, Color Removal
VT	AB, Pharma
MT	Protein, Enzyme
ST	BC
SM	BC, DC
MK	DC
V3	Alkalines
BN	Brine, Protein
V4	FR
BY	CWM, Particle
LY	CWM, Particle
V5	FR
BX	CWM, Particle
LX	CWM, Particle
A6	AP, Microbial
V6	CP
V7	Laundry Waste
LV	Corn Wet Milling
PX	Oil Removal
PY	Oil Removal, Enzyme Processing
PZ	Oil Removal, Enzyme Processing
UF5	Protein Concentration (High Solids)
UF10	Purification, Protein
UH004	Environment, metal, textile, paper, food, pharma/biotech, chemical
UP005	Environment, metal, textile, paper, food, pharma/biotech, chemical
UP010	Environment, metal, textile, paper, food, pharma/biotech, chemical
UP020	Environment, metal, textile, paper, food, pharma/biotech, chemical

ULTRAFILTRATION MEMBRANES (Continued)

DESIGNATION	APPLICATION
UH030	Environment, metal, textile, paper, food, pharma/biotech, chemical
UH050	Environment, metal, textile, paper, food, pharma/biotech, chemical
UP150	Environment, metal, textile, paper, food, pharma/biotech, chemical
US100	Environment, metal, textile, paper, food, pharma/biotech, chemical
UC500	Environment, metal, paint, paper, pharma/biotech
UV150	Environment, metal, paint, paper, pharma/biotech

MICROFILTRATION MEMBRANES

DESIGNATION	APPLICATION
JX	Industrial/Process
V0.1	Casein/Whey Fractionation
V0.2	Casein/Whey Fractionation
FR	Fat Removal in Whey Protein Isolation
TM10	Industrial/Process

CHEMICALLY RESISTANT MEMBRANES

DESIGNATION	APPLICATION
PEEK20	Solvent filtration, membrane distillation, pervaporation blotting
PEEK100	Solvent filtration, membrane distillation, pervaporation blotting
PVDF20	Solvent filtration, membrane distillation, pervaporation blotting
PVDF100	Solvent filtration, membrane distillation, pervaporation blotting
Duramem 150	Organic solvent nanofiltration, metal/chemical industry
Duramem 200	Organic solvent nanofiltration, metal/chemical industry
Duramem 300	Organic solvent nanofiltration, metal/chemical industry
Duramem 500	Organic solvent nanofiltration, metal/chemical industry
Duramem 900	Organic solvent nanofiltration, metal/chemical industry
Puramem 280	Organic solvent nanofiltration, metal/chemical industry
Puramem 600	Organic solvent nanofiltration, metal/chemical industry
Puramem Selective	Organic solvent nanofiltration, metal/chemical industry
Puramem Performance	Organic solvent nanofiltration, metal/chemical industry
Puramem Flux	Organic solvent nanofiltration, metal/chemical industry

SECTION 9: FLAT SHEET MEMBRANE BASIC TECHNICAL INFO

REVERSE OSMOSIS MEMBRANES

DESIGNATION	BRAND	POLYMER	MWCO	REJ-SIZE (NaCl)	pH RANGE (25°C)	TYPICAL FLUX (gfd/psi)
ACM1	TriSep	Polyamide TFC	0	99.5%	2-11	25/225
ACM2	TriSep	Polyamide TFC	0	99.5%	2-11	30/225
ACM3	TriSep	Polyamide TFC	0	99.3%	2-11	35/225
ACM4	TriSep	Polyamide TFC	0	99.2%	2-11	30/150
ACM5	TriSep	Polyamide TFC	0	98.5%	2-11	30/110
AG	GE	Polyamide TFC	0	99.5%	1-11	26/225
AK	GE	Polyamide TFC	0	99%	1-11	26/115
CE	GE	Cellulose Acetate	0	97%	1-11	23.5/420
SB50	TriSep	Cellulose Acetate Blend	0	95%	4-7	30/420
SE	GE	Polyamide TFC	0	98.9%	1-11	22/425
SG	GE	Polyamide TFC	0	98.2%	1-11	22/225
X201	TriSep	Polyamide TFC	0	99.5%	2-11	30/225
73AC	Toray	Polyamide TFC	0	99.8%	2-11	30.7/225
73HA	Toray	Polyamide TFC	0	99%	2-11	23.3/73
82V	Toray	Polyamide TFC	0	99.7%	2-11	27/798
SW30HR	Dow	Polyamide TFC	~100	99.6%	2-11	17-24/800
SW30XLE	Dow	Polyamide TFC	~100	99.5%	2-11	23-29/800
BW30	Dow	Polyamide TFC	~100	99.5%	2-11	26/255
BW30LE	Dow	Polyamide TFC	~100	99.5%	2-11	37-46/225
BW30XFR	Dow	Polyamide TFC	~100	99.7%	2-12	28-33/225
XLE	Dow	Polyamide TFC	~100	98.7%	2-11	33-41/125

NANOFILTRATION MEMBRANES

DESIGNATION	BRAND	POLYMER	MWCO	REJ-SIZE	pH RANGE (25°C)	TYPICAL FLUX (gfd/psi)
CK	GE	Cellulose Acetate	2,000	92% Na_2SO_4	2-8	28/220
DK	GE	Polyamide TFC	150-300	98% $MgSO_4$	2-10	22/100
DL	GE	Polyamide TFC	150-300	96% $MgSO_4$	2-10	31/100
HL	GE	Polyamide TFC	150-300	95% $MgSO_4$	3-9	39/100
DURACID	GE	Polyamide TFC	150-300	98% $MgSO_4$	0-9	10-19/225
TS40	TriSep	Polypiperazine -amide	200	40-60% NaCl 99% $MgSO_4$	2-11	20/110
TS80	TriSep	Polyamide TFC	150	80-90% NaCl 99% $MgSO_4$	2-11	20/110
SB90	TriSep	Cellulose Acetate Blend	150	85% NaCl 97% $MgSO_4$	-	30/225
XN45	TriSep	Polypiperazine -amide	500	10-30% NaCl 95% $MgSO_4$	2-11	35/110
NF	Dow	Polyamide TFC	200-400	99% $MgSO_4$	2-11	26.5-39.5/130
NF270	Dow	Polyamide TFC	200-400	99.2% $MgSO_4$	2-11	72-98/130
NF90	Dow	Polyamide TFC	200-400	-	2-11	46-60/125
NFX	Synder	Polyamide TFC	150-300	40% NaCl 99% $MgSO_4$	3-10.5	20-25/110
NFW	Synder	Polyamide TFC	300-500	20% NaCl 97% $MgSO_4$	4-10	45-50/110
NFG	Synder	Polyamide TFC	0.2 µm	10% NaCl 50% $MgSO_4$	4-10	55-60/110
NDX	Synder	Polyamide TFC	800-1,000	10% NaCl 50% $MgSO_4$	-	-
NP010	Microdyn	Polyethersulfone	1,000	50%	0-14	>200 lmh/ 40 bar
NP030	Microdyn	Polyethersulfone	500	35-75%	0-14	>40 lmh/ 40 bar

ULTRAFILTRATION MEMBRANES

DESIGNATION	BRAND	POLYMER	MWCO	REJ-SIZE	pH RANGE (25°C)	TYPICAL FLUX (gfd/psi)
GE	GE	Polyamide TFC	1,000	1K-PEG	1-11	20/400
GH	GE	Polyamide TFC	2,000	2K-PEG	1-11	20/150
GK	GE	Polyamide TFC	3,000	3K-PEG	1-11	17/75
PT	GE	Polyethersulfone	5,000	5K-Dextran	1-11	90/50
PW	GE	Polyethersulfone	10,000	10K-Dextran	1-11	85/30
MW	GE	Ultrafilic	100,000	50K-Protein	2-9	176/20
PY	Synder	Polyacrylonitrile	100,000	10 kDa	3-10	70-100/15
UA60	TriSep	Polypiperazine -amide	3,500	70% $MgSO_4$	2-11	35/110
UF5	TriSep	Polyethersulfone	5,000	-	2-11	50/20
UF10	TriSep	Polyethersulfone	10,000	-	2-11	100/20
UE50	TriSep	Polyethersulfone	100,000	-	2-11	100/20
XT	Synder	Polyethersulfone	1,000	1 kDa	1-11	75-80/50
VT	Synder	Polyethersulfone	3,000	3 kDa	1-11	110-127/50
MT	Synder	Polyethersulfone	5,000	5 kDa	1-11	120-147/50
ST	Synder	Polyethersulfone	10,000	10 kDa	1-11	130-167/50
SM	Synder	Polyethersulfone	20,000	20 kDa	2-11	147/60
MK	Synder	Polyethersulfone	30,000	30 kDa	1-11	181-193/50
V3	Synder	Polyvinylidene difluoride +	30,000	30 kDa	1-11	192-207/50
BN	Synder	Polyvinylidene difluoride	50,000	50 kDa	1-11	200-214/50
V4	Synder	Polyvinylidene difluoride +	70,000	70 kDa	1-11	157-168/50
LY	Synder	Polyethersulfone	100,000	100 kDa	1-11	270-289/50
BY	Synder	Polyvinylidene difluoride	100,000	100 kDa	1-11	162-173/30
V5	Synder	Polyvinylidene difluoride +	200,000	200 kDa	1-11	175-186/30
BX	Synder	Polyvinylidene difluoride	250,000	250 kDa	1-11	181-193/30
LX	Synder	Polyethersulfone	300,000	300 kDa	1-11	236-252/30
V6	Synder	Polyvinylidene difluoride +	500,000	500 kDa	1-11	182-196/30
A6	Synder	Polyvinylidene difluoride	500,000	500 kDa	1-11	191-214/30
V7	Synder	Polyvinylidene difluoride +	800,000	800 kDa	1-11	208-232/30

ULTRAFILTRATION MEMBRANES (Continued)

DESIGNATION	BRAND	POLYMER	MWCO	pH RANGE (25°C)	TYPICAL FLUX (gfd/psi)
UH004	Microdyn	Hydrophilic Polyethersulfone	4,000 kDa	0-14	7
UP005	Microdyn	Polyethersulfone	5,000 kDa	0-14	10
UP010	Microdyn	Polyethersulfone	10,000 kDa	0-14	50
UP020	Microdyn	Polyethersulfone	20,000 kDa	0-14	70
UP030	Microdyn	Hydrophilic Polyethersulfone	30,000 kDa	0-14	35
UH050	Microdyn	Hydrophilic Polyethersulfone	50,000 kDa	0-14	85
UP150	Microdyn	Polyethersulfone	150,000 kDa	0-14	286
US100	Microdyn	Hydrophilic Polysulfone	100,000 kDa	1-14	100
UC500	Microdyn	Regenerated Cellulose	500,000 kDa	1-11	250
UV150	Microdyn	Polyvinylidene difluoride	150,000 kDa	2-11	300

MICROFILTRATION MEMBRANES

DESIGNATION	BRAND	POLYMER	MWCO	pH RANGE (25°C)	TYPICAL FLUX (gfd/psi)
JX	GE	Polyvinylidene difluoride	0.3 µm	1-11	130/30
TM10	TriSep	Polyvinylidene difluoride	0.2 µm	2-11	50/10
FR	Synder	Polyvinylidene difluoride	800,000 kDa	1-11	233-249/30
V0.1	Synder	Polyvinylidene difluoride	0.1 µm	1-11	237-254/20
V0.2	Synder	Polyvinylidene difluoride	0.2 µm	1-11	245-280/20

CHEMICALLY RESISTANT MEMBRANES

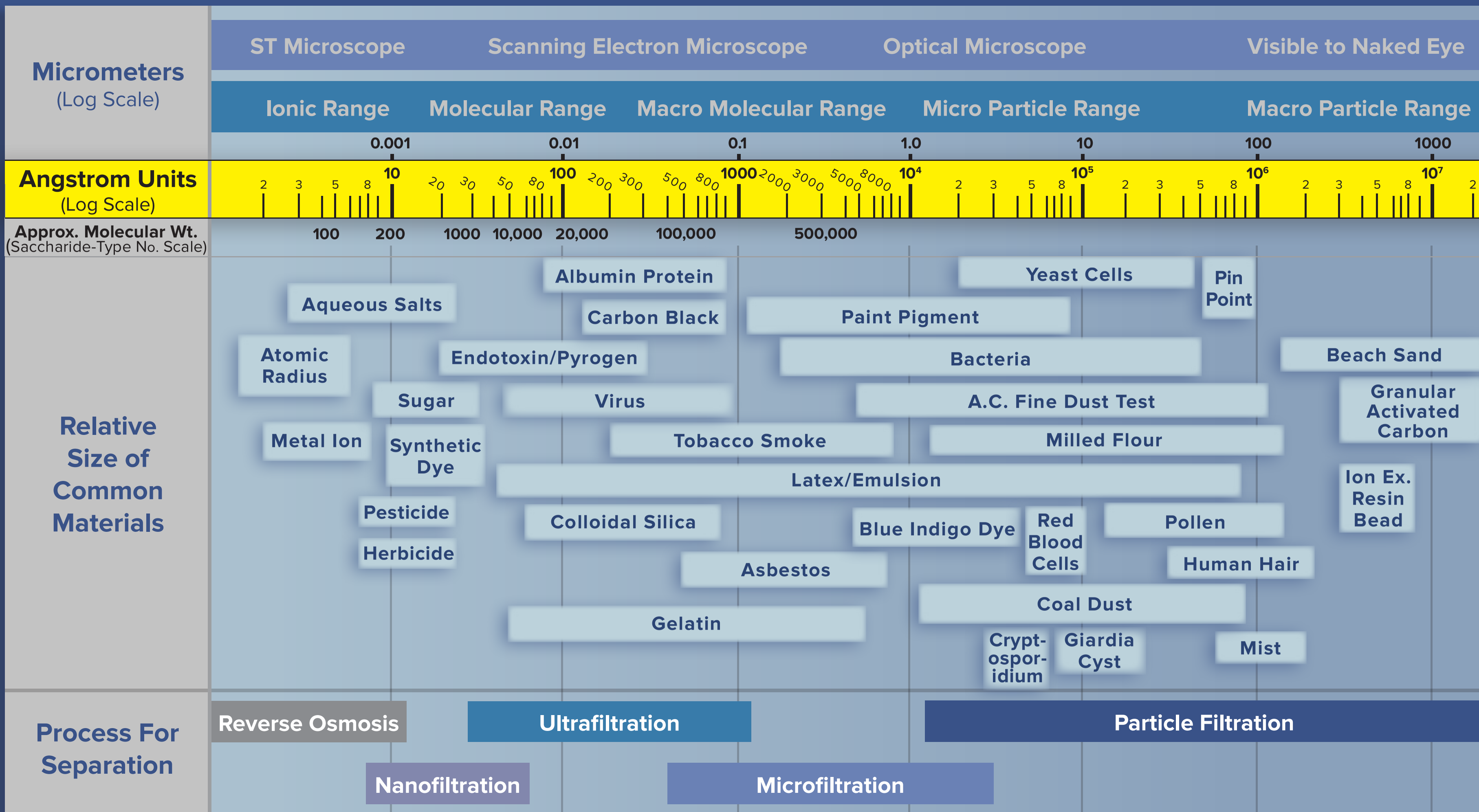
DESIGNATION	BRAND	POLYMER	MWCO	Thickness	pH	Liquid Ent Pressure
PEEK20	Novamem	Polyether ketone	0.02 µm	50 µm	1-14	>3 bar (43 psi)
PEEK100	Novamem	Polyether ketone	0.1 µm	50 µm	1-14	>2 bar (29 psi)
PVDF20	Novamem	Polyvinylidene difluoride	0.02 µm	50 µm	0-12	>5 bar (72 psi)
PVDF100	Novamem	Polyvinylidene difluoride	0.1 µm	50 µm	0-12	>3 bar (43 psi)

DESIGNATION	BRAND	POLYMER	MWCO	pH	Operating Pressure Range
Duramem 150	Evonik	P84 polyimide	150 Da	7	20-60 bar (290-870 psi)
Duramem 200	Evonik	P84 polyimide	200 Da	7	20-60 bar (290-870 psi)
Duramem 300	Evonik	P84 polyimide	300 Da	7	20-60 bar (290-870 psi)
Duramem 500	Evonik	P84 polyimide	500 Da	7	20-60 bar (290-870 psi)
Duramem 900	Evonik	P84 polyimide	900 Da	7	20-60 bar (290-870 psi)
Puramem 280	Evonik	P84 polyimide	280 Da	7	20-60 bar (290-870 psi)
Puramem 600	Evonik	P84 polyimide	600 Da	7	20-60 bar (290-870 psi)
Puramem Selective	Evonik	P84 polyimide	300-500 Da	7	20-60 bar (290-870 psi)
Puramem Performance	Evonik	P84 polyimide	300-500 Da	7	20-60 bar (290-870 psi)
Puramem Flux	Evonik	P84 polyimide	300-500 Da	7	20-60 bar (290-870 psi)

* This list is updated frequently. Visit www.sterlitech.com to see the latest offerings.

STERLITECH

The Filtration Spectrum



Note: 1 Micron (1 x 10^{-6} Meters) = 4 x 10^{-5} Inches (0.00004 Inches)

1 Angstrom Unit = 10^{-10} Meters = 10^{-4} Micrometers (Microns)   10 Angstrom Unit = 1 Nanometer

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Founded in 2001 in Kent, WA, Sterlitech Corporation manufactures and markets filtration-focused laboratory products to a broad spectrum of scientific and industrial sectors. Its line of flat sheet membranes and tangential flow cells deliver industry-leading performance and reliable results. Configured for reverse osmosis, nanofiltration, ultrafiltration, and microfiltration applications, Sterlitech's bench scale test equipment provides the versatility required to innovate.

Sterlitech's comprehensive line of products is supported by the expertise of its technical specialists who can assist with application-specific product selection, and provide customized solutions where necessary. Unique problem-solving approaches, flexibility, and consistent quality have made Sterlitech Corporation a renowned global provider of filtration products and equipment.

General Corporate Information

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