

Microporous filter membrane guide

Application properties

Membrane material	Primary application(s)	Relative flow rate [†]	Relative non-specific binding	Max. use temp.*	Water extractables	Typical class of wetting agent	Sterilization method [†]		
							Autoclave	Gamma irradiation	Ethylene oxide
Cellulose nitrate (CN)	Microbiological analysis, water testing, filtration of water, buffers and salt solutions; blotting	1	10	75°C	<3%	Non-ionic detergents	Yes, wet, liquid cycle	Yes	Yes
Cellulose acetate (CA)	Filtration of protein/nucleic acid containing solutions, sera, tissue culture media, buffers, salt solutions	2–3	3	75°C	<3%	Polyglycol ethers	Yes, wet, liquid cycle	Yes	Yes
Surfactant-free cellulose acetate (SFCA)	Filtration of protein/nucleic acid containing solutions, sera, tissue culture media, buffers, salt solutions	3	4	75°C	<1%	None	Yes, wet, liquid cycle	Yes	Yes
Mixed esters of cellulose (ME, MCE)	Microbiological analysis, water testing, filtration of water, buffers and salt solutions; blotting	2	9	75°C	<3%	Non-ionic detergents	Yes, wet, liquid cycle	Yes	Yes
Nylon, polyamide (NYL)	Filtration of tissue culture media, Water, Buffers, salt solutions, solvents; blotting	5	8	100°C	<1%	None	Yes, wet, liquid cycle	Marginal	Yes
Hydrophilic polyvinylidene fluoride (PVDF)	Filtration of protein/nucleic acid containing solutions, sera, tissue culture media, buffers, salt solutions, solvents; blotting	6	3	100°C	<1%	None	Yes	Marginal	Yes
Hydrophobic polyvinylidene fluoride (PVDF)	Filtration of gases and solvents; venting; blotting	6	10	100°C	<1%	None	Yes	Marginal	Yes
Polycarbonate (PC)	Cell/particle analysis and observation; epifluorescence	8	1	100°C	<1%, ~0% ^{§§}	Polyvinylpyrrolidone (PVP)	Yes	Yes	Yes
Polyester (PETE)	Cell/particle analysis and observation; epifluorescence	8	2	100°C	<1%~0% ^{§§}	Polyvinylpyrrolidone (PVP)	Yes	Yes	Yes
Tetrafluoroethylene (PTFE)	Gases and solvents filtration; venting	3–5	1	130°C	~0%	None	Yes	No	Yes

* Maximum use temperature will be dependent upon the holder the membrane is placed in and the solution being filtered.

** Ten (10) represents high non-specific binding and 1 represents low non-specific binding.

† A Marginal rating indicates that the membrane may withstand gamma irradiation depending upon the dose delivered.

‡ One (1) represents high flow rate and ten (10) represents low flow rate.

§ Solution dependent: low surface tension fluids (e.g., alcohols, etc.) are fast; aqueous.

Application properties continued

Membrane material	Primary application(s)	Relative flow rate [‡]	Relative non-specific binding	Max. use temp.*	Water extractables	Typical class of wetting agent	Sterilization method [†]		
							Autoclave	Gamma irradiation	Ethylene oxide
Polysulfone (PSF)	Filtration of protein/nucleic acid containing solutions, sera, tissue culture media, buffers, salt solutions	5	5	121°C	<0.6%	Polyvinylpyrrolidone (PVP)	Yes	Yes	Yes
Asymmetric polyethersulfone (aPES)	Filtration of protein/nucleic acid containing solutions, sera, tissue culture media, buffers, salt solutions	1	2	100°C	<1%	None	Yes	Yes	Yes
Polyethersulfone (PES)	Filtration of protein/nucleic acid containing solutions, sera, tissue culture media, buffers, salt solutions	1	2	100°C	<1%	Polyvinylpyrrolidone (PVP)	Yes	Yes	Yes
Polyvinyl chloride (PVC)	Air-borne particulate analysis	3–5	5	88°C	<3%	None	No	No	Yes
Hydrophilic polypropylene (PP)	Filtration of solvents, acids, bases, aqueous solutions	3–5	3	100°C	~0%	Polyol	Yes	Marginal	Yes
Hydrophobic polypropylene (PP)	Filtration of gases and solvents; Venting	3–5	4	100°C	~0%	None	Yes	Marginal	Yes
Acrylic copolymer	Prefiltration; filtration of aqueous solution, solvents	3–5	4	88°C	<3%	Unknown	No	Yes	Yes
Aluminum oxide (Al ₂ O ₃)	Filtration of solvents, aqueous solutions	5–10 [§]	4	400°C	~0%	None	Yes	Yes	Yes
Silver (Ag)	Air-borne particulate analysis	3-5	4	200C	~0%	None	Yes	No	Yes
Regenerated cellulose (RC)	Filtration of protein/nucleic acid containing solutions, sera, tissue culture media, buffers, salt solutions, solvents	2	1	100°C	<1%	None	Yes, wet, liquid cycle	Yes	Yes

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** Ten (10) represents high non-specific binding and 1 represents low non-specific binding.

† A Marginal rating indicates that the membrane may withstand gamma irradiation depending upon the dose delivered.

‡ One (1) represents high flow rate and ten (10) represents low flow rate.

§ Solution dependent: low surface tension fluids (e.g., alcohols, etc.) are fast; aqueous.

Material properties

Membrane material	Index of refraction	Color	Membrane structure	Surface texture	Brittleness ^{§§}	Porosity ^{††}	Typical thickness (μm)	Maximum temp.	Clearing agent(s)	Comments
Cellulose nitrate (CN)	1.512	Opaque, white, black	Cast, spongy	Open, rough	10	>85%	100–200	125°C	Immersion oil, toluene	Can be dissolved using DMSO
Cellulose acetate (CA)	1.47	Opaque, white	Cast, spongy	Open, rough	8	>85%	120–135	121°C	Immersion oil, paraffin oil, almond oil	Can be partially dissolved with acetin:acetone
Surfactant-free cellulose acetate (SFCA)	1.47	Opaque, white	Cast, spongy	Open, rough	8	>85%	120–135	121°C	Immersion oil, paraffin oil, almond oil	Can be partially dissolved with acetin:acetone
Mixed esters of cellulose (ME, MCE)	1.51	Opaque, white, black	Cast, spongy	Open, rough	9	>85%	30–50	130°C	Immersion oil	
Nylon, polyamide (NYL)	1.53	Opaque, white	Cast, spongy	Open, rough	2	>80%	100–185	125°C	a 3:2 mixture of DMSO and ethanol, immersion oil	
Hydrophilic polyvinylidene fluoride (PVDF)	1.42	Opaque, white/tan	Cast, spongy	Open, rough	2	≤70%	120–130	130°C	Tetrahydrofuran, immersion oil	
Hydrophobic polyvinylidene fluoride (PVDF)	1.407	Opaque, white/tan	Cast, spongy	Open, rough	2	≤70%	125–175	130°C	Tetrahydrofuran, immersion oil	
Polycarbonate (PC)	1.586	Translucent, white, black	Track etch	Smooth, flat	6	≈20%	5–20	130°C	Water	4.7 μm pore size is used for erythrocyte deformability
Polyester (PETE)	1.625	Translucent, white, black	Track etch	Smooth, flat	6	≈20%	5–20	130°C	Water	4.7 μm pore size is used for erythrocyte deformability
Tetrafluoroethylene (PTFE)	1.38	Opaque, white	Stretched	Open, rough	1	≤75%	20–200	120/260°C ^{‡‡}	Immersion oil	
Polysulfone (PSF)	1.633	Opaque, white	Cast, spongy	Open, rough	7	>85%	150–200	160°C	Immersion oil	
Asymmetric polyethersulfone (aPES)	1.64	Opaque, white, black	Cast, spongy	Open, rough	7	>85%	150–200	160°C	Immersion oil	

†† Porosity is a measure of the percentage of open pores in the membrane. It is not a measure of the diameter of the pores but a measure of the number of total pores present.

‡‡ Support material limit temperature, unsupported is higher.

§§ Ten (10) represents extremely brittle and one (1) represents low brittleness.

Material properties continued

Membrane material	Index of refraction	Color	Membrane structure	Surface texture	Brittleness ^{§§}	Porosity ^{††}	Typical thickness (μm)	Maximum temp.	Clearing agent(s)	Comments
Polyethersulfone (PES)	1.64	Opaque, white, black	Cast, spongy	Open, rough	7	>85%	150–200	160°C	Immersion oil	
Polyvinyl chloride (PVC)	1.54	Opaque, white	Cast, spongy	Open, rough	5	>85%	50–150	90°C	Immersion oil	
Hydrophilic polypropylene (PP)	1.49	Opaque, white	Stretched or cast spongy	Open, rough	1	≤ 75%	100–110	121°C	Immersion oil	
Hydrophobic polypropylene (PP)	1.49	Opaque, white	Stretched or cast spongy	Open, rough	1	≤75%	90–110	121°C	Immersion oil	
Acrylic copolymer	1.512	Opaque, white, black	Cast, spongy	Open, rough	4	>85%	135–150	90°C	Immersion oil	
Aluminum oxide (Al ₂ O ₃)	1.60	Opaque, white	Etched	Smooth, flat	10	≥75%	50–75	400°C	Water, immersion oil	
Silver (Ag)	N/A	Opaque, gray	Sintered	Smooth, flat	7	≥70%	50	300°C	N/A	Reusable, good for x-ray diffraction work
Regenerated cellulose (RC)	1.539	Opaque, white	Cast, spongy	Open, rough	8	>85%	65–75	180°C	Immersion oil	Good solvent resistance

†† Porosity is a measure of the percentage of open pores in the membrane. It is not a measure of the diameter of the pores but a measure of the number of total pores present.

‡‡ Support material limit temperature, unsupported is higher.

§§ Ten (10) represents extremely brittle and one (1) represents low brittleness.

Chemical resistance

Membrane material	Acids	Bases (caustics)	Alcohols	Ketones	Esters	Ethers	Oxidizers	Aldehydes	Aliphatic hydrocarbons	Aromatic hydrocarbons	Halogenated hydrocarbons
Cellulose nitrate (CN)	M	U	M	U	U	U	M	M	S	S	S
Cellulose acetate (CA)	M	M	S	U	U	U	U	U	S	S	M
Surfactant-free cellulose acetate (SFCA)	M	M	S	U	U	U	U	U	S	S	M
Mixed esters of cellulose (ME, MCE)	U	M	M	U	U	U	U	U	S	S	M
Nylon, polyamide (NYL)	U	S	S	S	M	S	U	S	S	S	S
Hydrophilic polyvinylidene fluoride (PVDF)	S	S	S	M	M	M	M	M	S	S	S
Hydrophobic polyvinylidene fluoride (PVDF)	S	S	S	M	M	M	M	M	S	S	S
Polycarbonate (PC)	S	M	M	U	M	M	M	U	U	U	M
Polyester (PETE)	S	U	S	U	U	M	U	U	M	U	U
Tetrafluoroethylene (PTFE)	S	S	S	S	S	S	S	S	S	S	S
Polysulfone (PSF)	S	S	S	U	M	U	U	M	M	M	M
Asymmetric polyethersulfone (aPES)	S	S	M	U	U	–	U	M	M	S	M
Polyethersulfone (PES)	S	S	S	U	M	–	U	M	M	S	M
Polyvinyl chloride (PVC)	S	S	S	U	U	U	U	U	U	U	U
Hydrophilic polypropylene (PP)	S	S	S	S	M	S	U	S	S	M	M
Hydrophobic polypropylene (PP)	S	S	S	S	M	S	U	S	S	M	M
Acrylic copolymer	S	S	S	U	S	M	U	U	M	S	U
Aluminum oxide (Al ₂ O ₃)	U	U	M	S	M	S	S	M	S	S	M
Silver (Ag)	M	S	S	–	S	S	U	–	–	–	S
Regenerated cellulose (RC)	M	M	S	S	S	S	U	–	S	S	S

E Excellent resistance

S Satisfactory resistance

M Marginal resistance; may be satisfactory for short-term exposure

U Unsatisfactory resistance; may cause failure and/or dissolve the membrane

– No data available

* Not suitable for aqueous solutions unless pre-wet with alcohol or other low surface tension fluid.

pH tolerance of membrane materials

Membrane material	Low pH (Acidic)	High pH (basic/caustic)
Cellulose nitrate (CN)	3	11
Cellulose acetate (CA)	3	9
Surfactant-free cellulose acetate (SFCA)	3	9
Mixed esters of cellulose (ME, MCE)	6	13
Nylon, polyamide (NYL)	6	11
Hydrophilic polyvinylidene fluoride (PVDF)	1	8
Hydrophobic polyvinylidene fluoride (PVDF)	1	8
Polycarbonate (PC)	1	8
Polyester (PETE)	3	7
Tetrafluoroethylene (PTFE)	1	14
Polysulfone (PSF)	2	14
Asymmetric polyethersulfone (aPES)	2	14
Polyethersulfone (PES)	2	13

Formula to calculate surface area (SA):

$$SA = \pi r^2$$

where r = the radius ($\frac{1}{2}$ the diameter) of the membrane π

and $\pi = 3.14159$

Membrane material	Low pH (Acidic)	High pH (basic/caustic)
Polyvinyl chloride (PVC)	4	12
Hydrophilic polypropylene (PP)	1	14
Hydrophobic polypropylene (PP)	1	14
Acrylic copolymer (polyester support)	3	7
Acrylic copolymer (nylon support)	5	14
Aluminum oxide (Al ₂ O ₃)	4	8
Silver (Ag)	2	10
Regenerated cellulose (RC)	2	10

* Not suitable for aqueous solutions unless pre-wet with alcohol or other low surface tension fluid.

pH range must not be used without reference to the chemicals providing the pH. Some membrane materials are particularly susceptible to certain acids or caustics regardless of pH and tolerate higher or lower pH with other compounds.

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