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Chemical Resistance

The following table contains an evaluation of chemical resistance to a number of fluids, judged to be either aggressive or not towards Polyethylene, Polypropylene or Polystyrene. In general common chemical names are used.

The evaluation is based on values obtained by immersion of test specimens in the fluid concerned at 20 °C and atmospheric pressure. It is a provisional classification (sat. sol = saturated aqueous solution, prepared at 20°C).

Actual chemical resistance of TPP products depends on many variables such as:

- exposure time
- concentration of chemicals
- thermal stress (e.g., autoclaving)
- exertion of force
- exposure to UV radiation
- aging, which may be caused by the action of detergents
- other environmental factors

The recommendations given from TPP are based on technical literature and information provided by the manufacturers of raw materials. They were prepared carefully and are intended as general guide for users of plastic materials. However, they cannot replace suitability testing performed by the user under actual working conditions. For the list of chemical resistance, following legend is valid:

+ = **Good chemical resistance**	± = **Good to limited chemical resistance**	– = **Poor chemical resistance t**
Continuous exposure to the substance does not cause damage within 30 days. The plastic may remain resistant for years.	Continuous exposure to the substance causes minor damages, some of which is reversible, within 7-30 days (e.g., swelling, softening, decrease of mechanical strength, discoloration).	Not suitable for continuous exposure to the substance. Immediate damage may occur (loss of mechanical strength, deformation, discoloration, cracking, dissolution).

Resistance to chemicals	Polyethylene (PE) 20 °C	Polypropylene (PP) 20 °C	Polystyrene (PS) 20 °C
A			
Acetaldehyde	±	±	-
Acetic acid	+	+	±
Acetic acid 5%	+	+	+
Acetic acid 50%	+	+	±
Acetic acid glacial	+	+	-
Acetone	+	+	-
Acetonitrile	+	+	-
Acetophenone	+	+	-
Adipic Acid	+	+	+
Allyl alcohol	+	+	±
Aluminium chloride	+	+	+
Amino acids	+	+	+
Ammonia aqueous sat. sol	+	+	+
Ammonia liquid 100%	+	+	±

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Resistance to chemicals	Polyethylene (PE) 20 °C	Polypropylene (PP) 20 °C	Polystyrene (PS) 20 °C
Ammonium acetate sat sol	+	+	+
Ammonium chloride sat. sol	+	+	+
Amyl acetate 100%	±	±	-
Amyl alcohol 100%	+	+	±
Aniline 100%	+	+	-
Aqua regia HCl / HNO_3= 3:1	-	-	-
Arsenic acid	+	+	+
B			
2-Butanol	+	+	±
Benzaldehyde	+	+	-
Benzene	-	-	-
Benzyl alcohol	±	-	-
Boric acid	+	+	+
Butyl acetate 100%	±	-	-
C			
Calcium chlorate	+	+	+
Calcium chloride	+	±	+
Calcium hydroxide	+	±	±
Calcium hypochlorite	+	±	+
Carbazole	+	+	+
Carbon tetrachloride	±	-	-
Chlorine aqueous sat sol	±	+	–
Chlorine liquid 100%	–	–	–
Chlorobenzene	±	–	–
Chloroform	±	±	–
Chromic acid up to 40%	–	+	+
Citric Acid sat. sol	+	+	+
Copper sulphate aq	+	+	+
D			
1,4-Dioxane	±	±	
Decahydronaphtalene (Decalin)	+	±	–
Dibutylphthalate	+	+	–
Diethyl ether	±	+	–
Diethyl malonate	+	+	–
Diethylene dioxide	+	+	
Diethylene glycol	+	+	±
Dimethylsulphoxide (DMSO)	+	+	+
E			
Ethyl acetate	+	±	–
Ethyl alcohol (absolute)	-	+	±
Ethyl alcohol 40%	+	+	±
Ethyl alcohol 96%	+	+	±
Ethylene chloride	-	-	
Ethylene glycol	+	+	+
Ethylene oxide 100%	±	±	–

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Resistance to chemicals	Polyethylene (PE) 20 °C	Polypropylene (PP) 20 °C	Polystyrene (PS) 20 °C
F			
Fatty acids	+	+	+
Fluorinated hydrocarbon	–	±	–
Fluorine	–	–	
Fluorine gas	-	-	–
Formaldehyde	+	+	–
Formaldehyde 10%	+	+	±
Formaldehyde 40%	+	+	–
Formic acid up to 100%	+	+	±
Formic acid up to 40%	+	+	±
H			
Hexane	+	+	±
Hydrobromic acid up to 100%	+	+	–
Hydrochloric acid	+	+	±
Hydrochloric acid 20%	+	+	+
Hydrochloric acid 5%	+	+	+
Hydrochloric acid up to 40%	+	+	+
Hydrofluoric acid 4%	+	+	±
Hydrofluoric acid 48%	+	+	–
Hydrogen peroxide 30%	+	+	
I			
Isopropanol	+	±	+
Isopropyl ether 100%	+	+	+
L			
Lactic acid 10%	+	+	±
Lactic acid up to 100%	+	+	±
Lead acetate	+	–	
M			
2-Methoxyethanol	+	+	-
Magnesium chloride sat sol	+	+	+
Mercury	+	+	+
Mercury hydroxid	+	+	±
Methanol 100%	+	+	±
Methoxyethyl oleate	+	+	–
Methyl alcohol	+	+	+
Methylene chloride	-	±	–
N			
n-Butanol	+	+	+
n-Octane	+	+	–
Nitric acid 40 - 50%	±	±	±
Nitric acid up to 30%	+	+	±
O			
Oxalic acid sat sol	+	+	+
Ozone	±	+	±

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Resistance to chemicals	Polyethylene (PE) 20 °C	Polypropylene (PP) 20 °C	Polystyrene (PS) 20 °C
P			
2-Propanol	+	+	+
Perchloroethylene	–	–	–
Petroleum ether	±	±	–
Phenol 90%	+	–	–
Phosphoric acid	+	+	+
Phosphoric acid 5%	+	+	±
Phosphoric acid 85%	+	+	+
Phosphorus trichloride	+		
Potassium hydroxide up to 50%	+	+	±
Potassium permanganate 30%	+	+	±
Propylene glycol	+	+	+
Pyridine	–	–	–
S			
Silicone oil	+	+	+
Silver nitrate	+	+	±
Sodium carbonate up to 50%	+	+	+
Sodium dichromate sat. sol	+	+	+
Sodium hydroxide 1%	±	+	±
Sodium hydroxide 10% - 60%	±	+	+
Sodium hypochlorite 15%	+	+	+
Stearic acid	+	+	+
Sulphuric acid 10 - 30%	+	+	±
Sulphuric acid 50%	+	+	±
Sulphuric acid 96%	±	±	–
Sulphuric acid 98%	±	±	–
Sulphuric acid up to 10%	+	+	+
T			
Tartaric acid sat sol	+	+	±
Tetrahydrofuran	-	±	–
Tincture of iodine	+	+	±
Toluene	±	±	–
Tributyl citrate	±	±	–
Trichloroethylene	-	–	–
Triethylene glycol	+	+	+
Tripropylene glycol	+	+	+
Trisodium phosphate	+	+	
U			
Urea sat sol	+	+	+
X			
Xylene	±	-	±
Z			
Zinc chloride sat sol	+	+	±
Zinc sulphate sat sol	+	+	+

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Chemical Compatibility of Filter Membrane PES / PET

The following table contains an evaluation of chemical resistance to a number of fluids, judged to be either aggressive or not towards PES and PET filter membrane. Actual chemical resistance depends on many variables, such as exposure time, thermal stress, exposure to UV radiation, temperature, pressure and length of exposure, aging, environmental factors, etc. The recommendations given from TPP are based on technical literature and information provided by the manufacturers of raw materials. They are a general guide for users of plastic materials and do not replace suitability testing performed by the user under actual working conditions.

For the list of chemical resistance, following legend is valid:

R Resistant	**LR** Limited Resistance	**NR** Not Resistant
No significant change was observed.	Moderate changes in physical properties or dimensions of the membrane were observed. The membrane may be suitable for short term, small volume and noncritical use.	The membrane is basically unstable. In most cases, extensive shrinkage or swelling of the membrane occurs. It may gradually weaken or partially dissolve after extended exposure.

ACIDS	**PES**	**PTFE**
Acetic Acid, 25%	R	R
Acetic Acid, 100%, glacial	LR	R
Formic Acid, 25%	R	R
Formic Acid, 100%	LR	R
Hydrochloric Acid, 25%	R	R
Hydrochloric Acid 37%, Conc.	R	R
Nitric Acid, 25%	NR	R
Nitric Acid, 60%	NR	R
Phosphoric Acid, 25%	-	R
Sulfuric Acid, 25%	NR	R
Sulfuric Acid, 98%, Conc.	NR	R
ALCOHOLS	**PES**	**PTFE**
Amyl Alcohol	NR	R
Benzyl Alcohol	NR	R
Ethanol (ethyl alcohol), 70%	LNR	R
Ethanol (ethyl alcohol), 98%	LNR	R
Ethylene Glycol	LR	R
Glycerol	LR	R
Isopropanol M	R	R
Methanol (methyl alcohol), 98%	LR	R
n-Propanol (propyl alcohol)	LR	R
Phenol	NR	R
Propylene Glycol	LR	R
BASES	**PES**	**PTFE**
Ammonium Hydroxide, 25%	NR	R
Ammonium Hydroxide, 1N	R	R
Potassium Hydroxide , 1N	R	R
Sodium Hydroxide, 5%	R	R
Sodium Hydroxide, 1N	LNR	R
Sodium Hydroxide, 6N	LNR	R
ESTERS	**PES**	**PTFE**
Amyl Acetate	NR	R
Butyl Acetate	NR	R
Benzyl Benzoate	NR	R
Ethyl Acetate	NR	R
2-Ethoxyethyl Acetate	R	R
Methyl Acetate	NR	R
Methyl Cellosolve Acetate	R	R
Propyl acetate	NR	R

HYDROCARBONS ALIPHATIC	**PES**	**PTFE**
Gasoline	LR	R
Hexane	NR	R
Kerosene	R	R
HYDROCARBONS AROMATIC	**PES**	**PTFE**
Toluene	LNR	R
Xylene	NR	R
HYDROCARBONS HALOGENTATED	**PES**	**PTFE**
Carbon Tetrachloride	R	R
Chloroform	R	R
Freon	LR	R
Methylene Chloride	NR	R
Monochlorobenzene	NR	R
Perchloroethylene	LR	R
1,1,1-Trichloroethane	LR	R
1,1,2-Trichloroethane	LR	R
Trichloroethylene	R	R
KETONES	**PES**	**PTFE**
Acetone	NR	R
Cyclohexanone	NR	R
Methyl Ethyl Ketone	NR	R
MISCELLANEOUS	**PES**	**PTFE**
Acetonitrile	LR	R
Acrylamide	R	R
Dimethylsulfoxide (DMSO)	NR	R
Dioxane	LR	R
Ethyl Ether	R	R
Formaldehyde, 30%	R	R
Hydrogen Peroxide, 30 %	-	R
Methyl Cellosolve	--	R
Pyridene	NR	R
Tetrahydrofuran	NR	R
Water	R	R

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