

Sterilization Stability of Resin Materials

Material	Gamma Radiation	Ethylene Oxide	Autoclave
Kynar	Excellent	Excellent	Excellent
Polycarbonate	Compatible to 10MRad dose with little loss of physical properties. Will discolor to light yellow-green hue.	Highly compatible with 100% EtO; may stress crack if sterilized in EtO/CFC mix, due to molding stresses.	Suitable, but may craze or stress crack due to molding stresses.
Polypropylene	Excellent up to commonly used sterilization doses (approx. 6 MRad).	Fair; may stress crack in EtO/CFC mix due to molding stresses.	Poor. Parts may distort due to low heat deflection temperature.
Nylon and Glass Filled Nylon	Physically compatible with commonly used sterilization doses, but may discolor to brownish hue.	Very Good. Some susceptibility to oxidizing agents.	Very Good. Components may swell slightly due to water absorption.
ABS	Compatible to 10 MRad dose with some loss of impact strength, but increased tensile strength. Some discoloration to slight brownish hue.	Excellent retention of properties for at least 5 sterilization cycles.	Poor. Parts may distort due to low heat deflection temperature.
Polysulfone	Excellent	Excellent	Excellent
Polyurethane (Tubing)	Excellent. Some discoloration may occur, but reverses over time. No significant effect on physical properties.	Excellent. No noticeable effect on material properties.	Not Recommended. Hydrolysis of polyurethane may create aromatic amine impurities.
Polyethylene (Tubing)	Excellent. Tensile strength increases and modulus of elasticity decreases due to crosslinking of polymer.	Excellent	Not Recommended. Tubing may distort at common autoclave temperatures.

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CHEMICAL RESISTANCE OF RESIN MATERIALS

Chemical	Kynar	Polycarbonate	Polypropylene	Nylon"	ABS	Polysulfone	Polyethylene	Polyurethane
Acetic Acid	10% 225 50% 200 120	25%, 75, LR Glacial 28%, 75 NR	97% 175	5% 75	50%,75	20% 70	75 120, LR	NR
Acetone	NR	NR	140	75	NR	NR	75, LR 120, NR	NR
Acetophenone	NR	---	140	75	NR	---	75	---
Acetylene	250	---	---	75	---	---	75	---
Air	285	---	210	185	75	320	140	255
Ammonia	Gas, NR Liquid, NR	5%, 75, LR NR	Gas, 140 30% liquid, 75	Liquid, 75	125	70	Gas, 140 Liquid, 140	Gas, 70
Ammonium Hydroxide	Concentrated, 225	5%, 75, NR	10% 140	10% 75 10% 160, NR	10% 75 10% 125, LR	29% 185	140	70
Barium Sulfide	275	---	140	75	125	---	140	---
Benzene	170	NR	75 210, LR	175	NR	NR	75, LR 120, NR	NR
Boric Acid	275	75	140	10% 75	125	---	140	70
Calcium Carbonate	285	---	140	---	125	---	120 140, LR	70
Carbon Dioxide	285	---	140	160	125	---	140	70
Carbon Monoxide	285	---	140	160	125	---	140	---
Carbon Tetrachloride	275	NR	210, LR	140	NR	NR	NR	70, LR
Chlorine	200	NR	NR	NR	NR	NR	NR	Gas, 70, LR
Chlorobenzene	170	NR	140, LR	120	NR	NR	NR	---
Chlorofluorocarbon 11	200	75, LR	---	75	---	75 250, NR	75, LR 120, NR	70b
Cyclohexanone	75	NR	75 140, LR	75	NR	NR	120 140, NR	NR
Dichloroethylene	225	---	75-	75	---	---	NR	---
Ethyl Acetate	75	NR	140	75	NR	NR	75 120, LR	NR
Ethyl Alcohol	285	75, LR	210	96% 75	40% 125 125, NR	75	75 140, NR 120, LR	70, LR
Ethylene Glycol	285	160, LR	140	75 140, NRC	125	70	140	70

Chemical	Kynar	Polycarbonate	Polypropylene Nylon"	ABS	Polysulfone	Polyethylene	Polyurethane
Ethylene Oxide	200	---	50d 75 175, LR	NRd	140	140	140
Fatty Acids	285	---	140	---	---	120 140, LR	---
Fluorine Formaldehyde	75 37% 125	10%, 75 30%, 75, NR NR	40%, 140	NR ----- 30%, 125 37% 75, NR	NR NR	NR 40%, 140	---
Gasoline	285		75 -210, LR 20%, 140	185	75 125, NR 125	70 75 120, LR 140	70
Glucose	285		210	---	125	70	140
Glycerin	285	160	10%, 210	NR	125	15%, 185 37%, 140 37%, 185, NR	140
Hydrochloric Acid	285	10%, 185	30%, 210, LR		35%, 125	140	70
Hydrofluoric Acid	4-0% 250 200	---	60%, 140	NR	48%, 75 48%, 125, LR	NR	40%, 120 4-1%, 140, LR
Hydrogen Peroxide	30% 200 90% 70	30%, 75	10%, 140 30%, 210, LR	0.5%, 75 30%, 75, NR	3%, 125 30%, 125, LR	70	50%, 140 90%, 120, NR
Isopropyl Alcohol	140	75, LR	140	140	75 125, NR	70, LR	75 120, LR
Kerosene	285	75, LR	---	185	125	70	75, LR 120, NR
Methyl Ethyl Ketone (MRK)	NR	---	140	140	NR	NR	75, LR 140, NR
Methylene Chloride	125	NR	75	75, LR	NR	NR	75, LR 140, NR
Nitric Acid	10% 175 50% 125 Concentrated, NR	NR	10% 210 60% 140, LR Concentrated, NR	2%, 75, LR 50%, 75, NR NR	25% 75 25% 125, NR 70%, 75, NR	5% 210 20% 75 71%, 75, NR	50%, 120, LR 95% 70, NR
Oxygen	285	---	---	75	---	210	140
Ozone	225	NR	---	95, LR	125	210	120, LR 140, NR
Phosphoric Acid	85% 225	25% 75, LR 25% 185, NR	95% 140	10%, 75, LR	85% 125	85% 250 85% 300, NR	50%, 140 100%, 75 100%, 140, LR
Propane	285	---	---	75	125	---	140
kktrn Chloride (Saturated Solution)	285	---	210	75	125	---	140
Sulfur-	93% 200 98% 150 Fuming, NR	40% 75 40% 160, LR	10% 210 60% 140 98%; 210, NR	NR	60% 125 70%, 75, LR 90%; 75, NR	65% 300 75% 300, NR 85% 210	70%, 140 90%, 120, LR 90% 140, NR
Tetrahydrofuran	NR	---	210, LR	75	NR	---	NR
Toluene	175	NR	140, LR	210	NR	NR	NR
Trichloroethylene	285	NR	210, LR	75	NR	NR	NR
Water	---	---	210	175, LR 175	125	285	140



Chemical Resistance of Resin Materials: Description of Information in Table and Related Notes

Each “cell” in Table 1 contains information regarding the suitability of the resin for use with a specified chemical. Up to three values are listed in each cell entry. Note that each cell may contain several data points, depending on the concentration, temperature, and resistance rating. Absence of a cell entry (-) indicates that data was not available. The cell contents are as follows:

[Concentration, Temp. in ° F, Resistance Rating]

Concentration:

If the chemical is diluted in water, the concentration of the chemical is given as percent by volume. If no value is shown, it may be assumed that the concentration was 100%. Also, if the form of the chemical is notable, such as fuming, gaseous, or liquid, it is shown here.

Temperature in degrees Fahrenheit:

Due to inconsistencies in testing protocols, it is impossible to present data which is totally homogeneous. Therefore, the temperature indicated may be either a temperature at which the resin was determined to be suitable for use or a temperature at which the chemical was maintained while suitability of the resin was determined. All temperatures have been rounded to the nearest 5” increment.

Resistance Rating:

(No Rating Shown) = Generally acceptable for use under the condition indicated, with negligible or limited absorption or attack, as indicated by available data.

LR = Limited resistance under the condition indicated. Resin may significantly absorb chemical, crack, or otherwise degrade. May be suitable for intermittent or short-term exposure or in applications where absorption is permissible.

NR = Resin is not recommended for use under condition indicated.

Example: The cell contents are “37%, 125” for the suitability of using a Kynar fitting in a system with formaldehyde. This indicates that Kynar is generally acceptable for use in contact with formaldehyde diluted to 37% concentration in water at temperatures up to 125 °F.

A second example would be an ABS part in contact with isopropyl alcohol (IPA). This material is generally acceptable for applications in contact with IPA at 75” F, but has limited resistance to it at 125” F, as indicated by the contents of the cell.

Footnotes to lettered superscripts in the table:

^a The reinforcing materials in glass-filled nylon tend to mask the effects of chemicals on the base resin. Therefore, glass-filled nylon is generally as resistant to chemical degradation as is the base resin, although verification of this is mandatory.

^b This chemical is readily absorbed by polyurethane rubber, but material properties are generally unaffected upon evaporation of the solvent.

^c Nylon 66 is generally not recommended for use with this chemical at elevated temperatures.

^d Data shown is for immersion in the chemical for at least four (4) weeks. Rating shown is distinct from the suitability of the resin for typical sterilization cycles.

Typical Resin Properties

Property	ASTM Test Method	Kynar	Polycarbonate	Polypropylene	Nylon™	GF Nylon™	AF3S	Polysulfone
Tensile Strength at Break, psi	D638	5,400	10,000	N/A	12,000	27,000	4,800	N/A
Elongation at break, %	D638	100-400	120	375	300	3	50	50-100
Tensile Yield Strength, psi	D638	6,500	9,200	4,400	12,000	N/A	5,700	10,200
Flexural Modulus, kpsi	D790	360	330	170	410	1,300	330	390
Rockwell Hardness	D785	R77	R118	R94	R121	M101	R107	R120
Coef. of Linear Thermal Expansion, 10 ⁻⁵ in/in/° F	D696	7.6	3.9	N/A	4.0	1.3	5.5	3.1
Deflection Temperature under Flexural Load, ° F, @ 264 psi	D648	244	266	N/A	194	480	173	345
Deflection Temperature under Flexural Load, ° F, @ 66psi	D648	N/A	273	190	455	N/A	N/A	358
Water Absorption, %, 24 hours	D570	0.015	0.15	0	1.2	0.7	0.25-0.40	0.3
Izod Impact (Notched), ft.-lb./in	D256	3.1	16	0.5	1.0	2.2	6.0	1.3

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The data for Nylon and Glass-Filled Nylon is for dry, as-molded coupons with approximately 0.2% water content.

N/A indicates data was not available from resin manufacturer or not applicable to that material.