Polypropylene
Chemical Resistance Table Polypropylene

Introduction

The table in this document summarises the data given in a number of polypropylene chemical resistance tables at present in use in various countries, derived from both practical experience and test results.

Source: ISO/TR 10358

The table contains an evaluation of the chemical resistance to a number of fluids judged to be either aggressive or not towards polypropylene. This evaluation is based on values obtained by immersion of polypropylene test specimens in the fluid concerned at 20, 60 and 100^{o}C and atmospheric pressure, followed in certain cases by the tensile characteristics.

A subsequent classification will be established with respect to a restricted number of fluids deemed to be technically or commercially more important, using equipment which permits testing under pressure and the determination of the “coefficient of chemical resistance” for each fluid. These tests will thus furnish more complete indications on the use of polypropylene piped for the transport of stated fluids, including their use under pressure.

Scope and Field Application

This document establishes a provisional classification of the chemical resistance of polypropylene with respect to about 180 fluids. It is intended to provide general guidelines on the possible utilisation of polypropylene piping for the conveyance of fluids:

- at temperatures up to 20, 60 and 100^{o}C
- in the absence of internal pressure and external mechanical stress (for example flexural stresses, stresses due to thrust, rolling loads etc).

Definitions, Symbols and Abbreviations

The criteria of classifications, definitions, symbols and abbreviations adopted in this document are as follows:

S = Satisfactory

The chemical resistance of polypropylene exposed to the action of a fluid is classified as “satisfactory” when the results of test are acknowledged to be “satisfactory” by the majority of the countries participating in the evaluation.

L = Limited

Borealis A/S
Lyngby Hovedgade 96
DK-2800 Kongens Lyngby (Denmark)
Telephone: +45 45 96 60 00
Fax : +45 45 96 61 23
www.borealisgroup.com

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The chemical resistance of polypropylene exposed to the action of fluid is classified as “limited” when the results of tests are acknowledged to be “limited” by the majority of the countries participating in the evaluation.

Also classified as “limited” are the resistances to the action of chemical fluids for which judgements “S” and “NS” or “L” are pronounced to an equal extent.

NS = Not satisfactory

The chemical resistance of polypropylene exposed to the action of a fluid classified as “not satisfactory” when the results of test are acknowledged to be “not satisfactory” by the majority of the countries participating in the evaluation.

Also classified as “not satisfactory” are materials for which judgement “L” and “NS” are pronounced to an equal extent.

Sat.sol	Saturated aqueous solution, prepared at 20^{o}C
Sol	Aqueous solution at a concentration higher than 10 % but not saturated
Dil.sol	Dilute aqueous solution at a concentration equal to or lower than 10 %
Work.sol	Aqueous solution having the usual concentration for industrial use

Solution concentrations reported in the text are expressed as a percentage by mass. The aqueous solutions of sparingly soluble chemicals are considered, as far as chemical action towards polypropylene in concerned, as saturated solutions.

In general, common chemical names are used in this document.

The table is made as a first guideline for user of polypropylene. If a chemical compound is not to be found or if there is an uncertainty on the chemical resistance in an application, please contact Borealis for advise and proposal on testing.

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Chemical Resistance of Polypropylene, Not Subjected to Mechanical Stress, to Various Fluids at 20, 60 and 100°C

Chemical or Product	Concentration	Temperature °C		
		20	60	100
Acetic acid	Up to 40 %	S	S	-
Acetic acid	50 %	S	S	L
Acetic acid, glacial	> 96 %	S	L	NS
Acetic anhydride	100 %	S	-	-
Acetone	100 %	S	S	-
Aceptophenone	100 %	S	L	-
Acrylonitrile	100 %	S	-	-
Air		S	S	S
Allyl alcohol	100 %	S	S	-
Almond oil		S	-	-
Alum	Sol	S	S	-
Ammonia, aqueous	Sat.sol	S	S	-
Ammonia, dry gas	100 %	S	-	-
Ammonia, liquid	100 %	S	-	-
Ammonium acetate	Sat. sol	S	S	-
Ammonium chloride	Sat.sol	S	S	-
Ammonium fluoride	Up to 20 %	S	S	-
Ammonium hydrogen carbonate	Sat.sol	S	S	-
Ammonium metaphosphate	Sat.sol	S	S	S
Ammonium nitrate	Sat.sol	S	S	S
Ammonium persulphate	Sat.sol	S	S	-
Ammonium phosphate	Sat.sol	S	-	-
Ammonium sulphate	Sat.sol	S	S	S
Ammonium sulphide	Sat.sol	S	S	-
Amyl acetate	100 %	L	-	-
Amyl alcohol	100 %	S	S	S
Aniline	100 %	S	S	-
Apple juice		S	-	-
Aqua regia	HCl/HNO_3=3/1	NS	NS	NS
Barium bromide	Sat.sol	S	S	S
Barium carbonate	Sat.sol	S	S	S
Barium chloride	Sat.sol	S	S	S

Borealis A/S
Lyngby Hovedgade 96,
DK-2800 Kongens Lyngby (Denmark)
Telephone: +45 45 96 60 00
Fax : +45 45 96 61 23
www.borealisgroup.com

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Chemical or Product	Concentration	Temperature °C		
		20	60	100
Barium hydroxide	Sat.sol	S	S	S
Sulphide	Sat.sol	S	S	S
Beer		S	S	-
Benzene	100 %	L	NS	NS
Benzoic acid	Sat.sol	S	S	-
Benzyl alcohol	100 %	S	L	-
Borax	Sol	S	S	-
Boric acid	Sat.sol	S	-	-
Boron trifluoride	Sat.sol	S	-	-
Bormine, gas		NS	NS	NS
Bromine, liquid	100 %	NS	NS	NS
Butane, gas	100 %	S	-	-
Butanol	100 %	S	L	L
Butyl acetate	100 %	L	NS	NS
Butyl glycol	100 %	S	-	-
Butyl phenols	Sat.sol	S	-	-
Butyl phthalate	100 %	S	L	L
Calcium carbonate	Sat.sol	S	S	S
Calcium chlorate	Sat.sol	S	S	-
Calcium chloride	Sat.sol	S	S	S
Calcium hydroxide	Sat.sol	S	S	S
Calcium hypochlorite	Sol	S	-	-
Calcium nitrate	Sat.sol	S	S	-
Camphor oil		NS	NS	NS
Carbon dioxide, dry gas		S	S	-
Carbon dioxide, wet gas		S	S	-
Carbon disulphide	100 %	S	NS	NS
Carbon monoxide, gas		S	S	-
Carbon tetrachloride	100 %	NS	NS	NS
Castor oil	100 %	S	S	-
Caustic soda	Up to 50 %	S	L	L
Chlorine, aqueous	Sat.sol	S	L	-
Chlorine, dry gas	100 %	NS	NS	NS
Chlorine, liquid	100 %	NS	NS	NS
Chloroacetic acid	Sol	S	-	-

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Chemical or Product	Concentration	Temperature °C		
		20	60	100
Chloroethanol	100 %	S	-	-
Chloroform	100 %	L	NS	NS
Chlorosulphonic acid	100 %	NS	NS	NS
Chrome alum	Sol	S	S	-
Chromic acid	Up to 40 %	S	L	NS
Citric acid	Sat.sol	S	S	S
Coconut oil		S	-	-
Copper (II) chloride	Sat.sol	S	S	-
Copper (II) nitrate	Sat.sol	S	S	S
Copper (II)	Sat.sol	S	S	-
Corn oil		S	L	-
Cottonseed oil		S	S	-
Cresol	Greater than 90 %	S	-	-
Cyclohexane	100 %	S	-	-
Cyclohexanol	100 %	S	L	-
Cyclohexanone	100 %	L	NS	NS
Decalin (decahydronaphthalene)	100 %	NS	NS	NS
Dextrin	Sol	S	S	-
Dextrose	Sol	S	S	S
Dibutyl phthalate	100 %	S	L	NS
Dichloroacetic acid	100 %	L	-	-
Dichloroethylene (A and B)	100 %	L	-	-
Diethanolamine	100 %	S	-	-
Diethyl ether	100 %	S	L	-
Diethylene glycol	100 %	S	S	-
Diglycolic acid	Sat.sol	S	-	-
Diisooctyl	100 %	S	L	-
Dimethyl amine, gas		S	-	-
Dimethyl formamide	100 %	S	S	-
Dioctyl phthalate	100 %	L	L	-
Dioxane	100 %	L	L	-
Distilled water	100 %	S	S	S
Ethanolamine	100 %	S	-	-
Ethyl acetate	100 %	L	NS	NS

Borealis A/S
Lyngby Hovedgade 96,
DK-2800 Kongens Lyngby (Denmark)
Telephone: +45 45 96 60 00
Fax : +45 45 96 61 23
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Chemical or Product	Concentration	Temperature °C		
		20	60	100
Ethyl alcohol	Up to 95 %	S	S	S
Ethyl chloride, gas		NS	NS	NS
Ethylene chloride (mono and di)		L	L	-
Ethyl ether	100 %	S	L	-
Ethylene glycol	100 %	S	S	S
Fertic chloride	Sat.sol	S	S	S
Formaldehyde	40 %	S	-	-
Formic acid	10 %	S	S	L
Formic acid	85 %	S	NS	NS
Formic acid, anhydrous	100 %	S	L	L
Fructose	Sol	S	S	S
Fruit juice		S	S	S
Gasoline, petrol (aliphatic hydrocarbons)		NS	NS	NS
Gelatine		S	S	-
Glucose	20 %	S	S	S
Glycerine	100 %	S	S	S
Glycolic acid	30 %	S	-	-
Heptane	100 %	L	NS	NS
Hexane	100 %	S	L	-
Hydrobromic acid	Up to 48 %	S	L	NS
Hydrochloric acid	Up to 20 %	S	S	S
Hydrochloric acid	30 %	S	L	L
Hydrochloric acid	From 35 to 36 %	S	-	-
Hydrofluoric acid	Dil.sol	S	-	-
Hydrofluoric acid	40 %	S	-	-
Hydrogen	100 %	S	-	-
Hydrogen chloride, dry gas	100 %	S	S	-
Hydrogen peroxide	Up to 10 %	S	-	-
Hydrogen peroxide	Up to 30 %	S	L	-
Hydrogen sulphide, dry gas	100 %	S	S	-
Iodine, in alcohol		S	-	-
Isoctane	100 %	L	NS	NS

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Chemical or Product	Concentration	Temperature °C		
		20	60	100
Isopropyl alcohol	100 %	S	S	S
Isopropyl ether	100 %	L	-	-
Lactic acid	Up to 90 %	S	S	-
Lanoline		S	L	-
Linseed oil		S	S	S
Magnesium carbonate	Sat.sol	S	S	S
Magnesium chloride	Sat.sol	S	S	-
Magnesium hydroxide	Sat.sol	S	S	-
Magnesium sulphate	Sat.sol	S	S	-
Malic acid	Sat.sol	S	S	-
Mercury (ll) chloride	Sat.sol	S	S	-
Mercury (ll) cyanide	Sat.sol	S	S	-
Mercury (l) nitrate	Sol	S	S	-
Mercury	100 %	S	S	-
Methyl acetate	100 %	S	S	-
Methyl alcohol	5 %	S	L	L
Methyl amine	Up to 32 %	S	-	-
Methyl bromide	100 %	NS	NS	NS
Methyl ethyl ketone	100 %	S	-	-
Methylene chloride	100 %	L	NS	NS
Milk		S	S	S
Monochloroacetic acid	>85 %	S	S	-
Naphtha		S	NS	NS
Nickel chloride	Sat.sol	S	S	-
Nickel nitrate	Sat.sol	S	S	-
Nickel sulphate	Sat.sol	S	S	-
Nitric acid	Up to 30 %	S	NS	NS
Nitric acid	From 40 to 50 %	L	NS	NS
Nitric acid, fujming (with nitrogen dioxide)		NS	NS	NS
Nitrobenzene	100%	S	L	_
Oleic acid	100 %	S	L	-
Oleum (sulphuric acid with 60 % of SO3)		S	L	-

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Lyngby Hovedgade 96,
DK-2800 Kongens Lyngby (Denmark)
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Chemical or Product	Concentration	Temperature °C		
		20	60	100
Olive oil		S	S	L
Oxalic acid	Sat.sol	S	L	NS
Oxygen, gas		S	-	-
Paraffin oil (FL65)		S	L	NS
Peanut oil		S	S	-
Peppermint oil		S	-	-
Perchloric acid	(2 N) 20 %	S	-	-
Petroleum ether (ligroine)		L	L	-
Phenol	5 %	S	S	-
Phenol	90 %	S	-	-
Phosphine, gas		S	S	-
Phosphoric acid	Up.to 85 %	S	S	S
Phosphorus oxychloride	100 %	L	-	-
Picric acid	Sat.sol	S	-	-
Potassium bicarbonate	Sat.sol	S	S	S
Potassium borate	Sat.sol	S	S	-
Potassium bromate	Up to 10 %	S	S	-
Potassium bromide	Sat.sol	S	S	
Potassium carbonate	Sat.sol	S	S	
Potassium chlorate	Sat.sol	S	S	
Potassium chlorite	Sat.sol	S	S	
Potassium chromate	Sat.sol	S	S	
Potassium cyanide	Sol	S	-	
Potassium dichromate	Sat.sol	S	S	S
Potassium ferricyanide	Sat.sol	S	S	-
Potassium fluoride	Sat.sol	S	S	-
Potassium hydroxide	Up to 50 %	S	S	S
Potassium iodide	Sat.sol	S	-	-
Potassium nitrate	Sat.sol	S	S	-
Potassium perchlorate	10 %	S	S	-
Potassium permanganate	(2 N) 30 %	S	-	-
Potassium persulphate	Sat.sol	S	S	-
Potassium sulphate	Sat.sol	S	S	-
Propane, gas	100 %	S	-	-
Propionic acid	>50 %	S	-	-

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Chemical or Product	Concentration	Temperature °C		
		20	60	100
Pyridine	100 %	L	-	-
Seawater		S	S	S
Silicon oil		S	S	S
Silver nitrate	Sat.sol	S	S	L
Sodium acetate	Sat.sol	S	S	S
Sodium benzoate	35 %	S	L	-
Sodium bicarbonate	Sat.sol	S	S	S
Sodium carbonate	Up to 50 %	S	S	L
Sodium chlorate	Sat.sol	S	S	-
Sodium chloride	Sat.sol	S	S	-
Sodium chlorite	2 %	S	L	NS
Sodium chlorite	20 %	S	L	NS
Sodium dichromate	Sat.sol	S	S	S
Sodium hydrogen carbonate	Sat.sol	S	S	S
Sodium hydrogen sulphate	Sat.sol	S	S	-
Sodium hydrogen sulphite	Sat.sol	S	-	-
Sodium hydroxide	1 %	S	S	S
Sodium hydroxide	From 10 to 60 %	S	S	S
Sodium hypochlorite	5 %	S	S	-
Sodium hypochlorite	10 % - 15 %	S	-	-
Sodium hypochlorite	20 %	S	L	-
Sodium metaphosphate	Sol	S	-	-
Sodium nitrate	Sat.sol	S	S	-
Sodium perborate	Sat.sol	S	S	-
Sodium phosphate (neutral)		S	S	S
Sodium silicate	Sol	S	S	-
Sodium sulphate	Sat.sol	S	S	-
Sodium sulphide	Sat.sol	S	-	-
Sodium sulphite	40 %	S	S	S
Sodium thiosulphate (hypo)	Sat.sol	S	-	-
Soybean oil		S	L	-
Succinic acid	Sat.sol	S	S	-
Sulphuric acid	Up to 10 %	S	S	S
Sulphuric dioxide, dry or wet	100 %	S	S	-

Borealis A/S
Lyngby Hovedgade 96,
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		20	60	100
Sulphur acid	From 10 to 30 %	S	S	-
Sulphuric acid	50 %	S	L	L
Sulphuric acid	96 %	S	L	NS
Sulphuric acid	98 %	L	NS	NS
Sulphurous acid	Up to 30 %	S	-	-
Tartaric acid	Sat.sol	S	S	-
Tetrahydrofuran	100 %	L	NS	NS
Tetralin	100 %	NS	NS	NS
Thiophene	100 %	S	L	-
Tin (IV) chloride	Sol	S	S	-
Tin (II) chloride	Sat.sol	S	S	-
Toluene	100 %	L	NS	NS
Trichloroacetic acid	Up to 50 %	S	S	-
Trichloroethylene	100 %	NS	NS	NS
Triethanolamine	Sol	S	-	-
Turpentine		NS	NS	NS
Urea	Sat.sol	S	S	-
Vinegar		S	S	-
Water brackish, mineral, potable		S	S	S
Whiskey		S	S	-
Wines		S	S	-
Xylene	100 %	NS	NS	NS
Yeast	Sol	S	S	S
Zinc chloride	Sat.sol	S	S	-
Zinc sulphate	Sat.sol	S	S	-