



“More than you need to know?”

Useful properties of some solvents commonly used in chromatography

[Bracketed values are from Merck Index or as noted]

Solvent [Order for elution (Note 2)]	Polarity index (Note 1)	Dielectric constant % w/w	Solubility in water	Boiling point (°C) (°C)	Flash point mice or rats in air (ppm)	LD₅₀ or Lethal concentrations for mice or rats in air (ppm)
Acetic acid	6.2	6.15	100	118°	None	Causes skin burns
Acetone [10]	5.1	20.7	100	56.5°	-20°	10.7 ml/ kg/ oral / rat
Acetonitrile	5.8	37.5 [38.8]	100	81.6°	12.8°	3.8 gm/ kg/ oral / rat
Benzene [5]	2.7	2.284	0.18 (Note 3)	80.1°	10-12°	3.8 ml/ kg/ oral / rat
<i>n</i>-Butanol [11]	3.9	17.8	7.81 (Note 4)	117-118°	36-38°	4.36 gm/ kg/ oral / rat
Carbon tetrachloride [3]	1.6	2.238	0.08 (Note 5)	76.7	None	~10,000 ppm Known liver toxin (Note 6)
Chloroform [7]	4.1	4.8	0.815 (Note 7)	61-62°	None	Known liver toxin (Note 8)
Cyclohexane	0.2	2.023	0.01	80.7°	-18°	60-70 mg/liter of air in mice
Diethylamine	na	na	100	56.3° [55.5°]	< -6.7°	540 mg/ kg/ oral/ rats
Diethyl ether [8]	2.8	4.335 (9.)	6.89 (Note 10)	34.6°	-45° (Note 11)	
Dimethylamine (anhydrous)	na	na	100	6.88° (Note 12)	0°	4.0 gm/ kg/ iv/ rabbit
Dimethyl sulfoxide	7.2	4.7 [4.5]	100	189°	95°	>20 gm/ kg/ oral / rat
Dimethyl- formamide	na	6.4	100	155° [153°]	67°	1122 mg/ kg/ oral / mouse (Note 13)
Dioxane	4.8	2.209	100	101.1°	5-18°	6.0 gm/ kg/ oral / rat 5000 ppm Known human toxin (Note 14)
Ethanol [13]	5.2	24.30	100	78.5°	9-11°	13.7 gm/ kg/ oral / rat
Ethyl acetate [9]	4.4	6.02	8.7 (Note 15)	77°	7.2°	11.3 gm/ kg/ oral / rat
Heptane	0.0	-	0.0003	98.4°	-1°	15,900 ppm

Solvent properties continued:

Solvent [Order for elution] (Note 1) [(Note 2)]	Polarity index (Note 1)	Dielectric constant % w/w	Solubility in water	Boiling point (°C) (°C)	Flash point mice or rats in air (ppm)	LD₅₀ or Lethal concentrations for mice or rats in air (ppm)
Hexane [2]	0.0	1.890	0.001	69°	na	40,000 ppm
Methyl ethyl-ketone	4.7	18.5	24 (Note 16)	79.6°	1.67°	6.86 ml/ kg/ oral / rat
Methanol [14]	5.1	32.63 (25°) 33.62 (20°)	100	64.7°	12°	< 30 ml can kill human Usual fatal human dose: 100-250 ml. (Note 17)
Methylene chloride [6]	3.1	9.08	1.6 (18.)	39.75°	None	1.6 ml/ kg/ oral / rat Liver toxin (Note 19)
i-Propanol [12]	3.9	18.2	100	82.5°	11.7°	5.8 gm/ kg/ oral / rat 100 ml can be fatal to humans
n-Propanol	4.0	20.1	100	92° [97.2°]	22°	1.87 gm/ kg/ oral / rat
Pentane [1]	0.0	1.844	0.004 (0.36 gm/l; 16°C)	36°	-40°	128,200 ppm
Pyridine		12.3	100	115.5°		4000 ppm. Liver toxin
Tetrahydrofuran	4.0	na	100	65° [66° Merck; 67° CRC]	1°	Known human toxin
Toluene [4]	2.4	2.379	0.51	110.6°	6-10°	7.53 ml/ kg/ oral / rat
Water [15]	9.0	80.37 (20°) 78.54 (25°)	100	100°	None	None
Xylene	2.5	<i>p</i> - = 2.27; <i>m</i> - = 2.374; <i>o</i> - = 2.568 (Note 20)	0.018 <i>m</i> -: 139.3°;	137-140° <i>p</i> -: 137-138°; than benzene <i>o</i> -: 144° (Note 20)	29°	Unclear. Thought a little bit less toxic

Please note that ALL solvents are toxic (except perhaps for water)
Many, if not most, of the solvents listed above can seriously damage the brain,
central nervous system, liver, kidneys, spleen, bone marrow and other vital
organs with either prolonged or repeated exposures.
Many are suspected or proven carcinogens in laboratory animals.
Eye, skin & respiratory protection are absolutely required
to help minimize the risk of serious injury or damage

Notes for Solvent properties table

- 1 All at 20°C, except for Acetone, Benzene, Dioxane, Ethanol, Ethyl acetate and both Propanols, which were measured at 25°C
- 2 Please note:
This order of increasing elution power is not agreed upon in all texts nor recommended in all applications.
In general, they should be used in the order of increasing polarity.
However, the specific type and form of the column packing material of choice can affect the order that is used.
- 3 1 ml is soluble in 1430 parts water
- 4 9.1 ml will dissolve in 100 ml of water at 25°
- 5 1 ml is soluble in 2000 parts water
- 6 Known to cause human liver & kidney damage.
Confirmed carcinogen in animals.
There is one known case that a human was reported to develop a liver tumor after acute exposure.
To quote SAX ***“respiratory or dermal exposure should be avoided by all means”***
- 7 1 ml is soluble in 200 parts water; 25°C
- 8 Known toxic action on heart, liver & kidneys.
Suspected, as with similar chlorinated solvents, of being a liver carcinogen. (Proven as such in some but not all animals. Produces birth defects in chickens.)
Humans metabolize methylene chloride into **carbon monoxide** so anyone with heart problems should take pains to avoid ANY exposure to this solvent
- 9 4.197 at 26.9°C
- 10 Ether can dissolve up to 1.2% water at 20°C;
Water can dissolve up to 8.43% at 15°; 6.05% at 25°.
HCl increases water solubility.
- 11 Shaken under totally dry conditions, ether can generate enough static electricity to start a fire
- 12 Gas at room temperature. Normally marketed as a compressed liquid or else as a 33% aqueous solution
- 13 Prolonged exposure to as low as 100 ppm has been shown to produce liver injury
- 14 Human deaths via industrial inhalation have resulted due to liver and kidney necrosis
- 15 1 ml dissolve in 10 ml of water at 25°.
More soluble at lower temperatures and less soluble at higher temperatures.
- 16 1 part is soluble in ~4 parts water; less soluble at higher temperatures
- 17 Chronic, or acute, exposure can cause brain damage, visual impairment or blindness
(Injury may be permanent)
- 18 1 part is soluble in around 50 part water
- 19 Also known to attack the eyes & nervous system
- 20 Commercial Xylene (Xylol) is a mixture of three isomers (*p*-, *o*- and *m*-Xylene) with *m*-Xylene predominating.
- 21 *p*-Xylene 137-138°;
m-Xylene 139.3°;
o-Xylene 144°



Lophophora williamsii

Trichocereus glaucus Knize *nomen confusum*



Trichocereus peruvianus
KK242



Trichocereus peruvianus
RS0003

