



“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)	LD <sub>50</sub> or Lethal concentrations for
<b>Acetic acid</b>	6.2	6.15	100	118°	None	Causes skin burns
<b>Acetone</b> [10]	5.1	20.7	100	56.5°	-20°	10.7 ml/ kg/ oral / rat
<b>Acetonitrile</b>	5.8	37.5 [38.8]	100	81.6°	12.8°	3.8 gm/ kg/ oral / rat
<b>Benzene</b> [5]	2.7	2.284	0.18 (Note 3)	80.1°	10-12°	3.8 ml/ kg/ oral / rat
<b>n-Butanol</b> [11]	3.9	17.8	7.81 (Note 4)	117-118°	36-38°	4.36 gm/ kg/ oral / rat
<b>Carbon tetrachloride</b> [3]	1.6	2.238	0.08 (Note 5)	76.7	None	~10,000 ppm Known liver toxin (Note 6)
<b>Chloroform</b> [7]	4.1	4.8	0.815 (Note 7)	61-62°	None	Known liver toxin (Note 8)
<b>Cyclohexane</b>	0.2	2.023	0.01	80.7°	-18°	60-70 mg/liter of air in mice
<b>Diethylamine</b>	na	na	100	56.3° [55.5°]	< -6.7°	540 mg/ kg/ oral/ rats
<b>Diethyl ether</b> [8]	2.8	4.335 (9.)	6.89 (Note 10)	34.6°	-45° (Note 11)	
<b>Dimethylamine</b> (anhydrous)	na	na	100	6.88° (Note 12)	0°	4.0 gm/ kg/ iv/ rabbit
<b>Dimethyl sulfoxide</b>	7.2	4.7 [4.5]	100	189°	95°	>20 gm/ kg/ oral / rat
<b>Dimethyl- formamide</b>	na	6.4	100	155° [153°]	67°	1122 mg/ kg/ oral / mouse (Note 13)
<b>Dioxane</b>	4.8	2.209	100	101.1°	5-18°	6.0 gm/ kg/ oral / rat 5000 ppm Known human toxin (Note 14)
<b>Ethanol</b> [13]	5.2	24.30	100	78.5°	9-11°	13.7 gm/ kg/ oral / rat
<b>Ethyl acetate</b> [9]	4.4	6.02	8.7 (Note 15)	77°	7.2°	11.3 gm/ kg/ oral / rat
<b>Heptane</b>	0.0	-	0.0003	98.4°	-1°	15,900 ppm

**Solvent properties continued:**

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)	LD <sub>50</sub> or Lethal concentrations for
<b>Hexane</b> [2]	0.0	1.890	0.001	69°	na	40,000 ppm
<b>Methyl ethyl- ketone</b>	4.7	18.5	24 (Note 16)	79.6°	1.67°	6.86 ml/ kg/ oral / rat
<b>Methanol</b> [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)
<b>Methylene chloride</b> [6]	3.1	9.08	1.6 (18.)	39.75°	None	1.6 ml/ kg/ oral / rat Liver toxin (Note 19)
<b><i>i</i>-Propanol</b> [12]	3.9	18.2	100	82.5°	11.7°	5.8 gm/ kg/ oral / rat 100 ml can be fatal to humans
<b><i>n</i>-Propanol</b>	4.0	20.1	100	92° [97.2°]	22°	1.87 gm/ kg/ oral / rat
<b>Pentane</b> [1]	0.0	1.844	0.004 (0.36 gm/l; 16°C)	36°	-40°	128,200 ppm
<b>Pyridine</b>		12.3	100	115.5°		4000 ppm. Liver toxin
<b>Tetrahydrofuran</b>	4.0	na	100	65° [66° Merck; 67° CRC]	1°	Known human toxin
<b>Toluene</b> [4]	2.4	2.379	0.51	110.6°	6-10°	7.53 ml/ kg/ oral / rat
<b>Water</b> [15]	9.0	80.37 (20°) 78.54 (25°)	100	100°	None	None
<b>Xylene</b>	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°



*Trichocereus glaucus* Knize *nomen confusum*



*Trichocereus peruvianus*  
KK242



*Trichocereus peruvianus*  
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