TBF ENVIRONMENTAL Solvency Comparison Chart

LEADERS IN LOW-VOC SOLVENT SOLUTIONS

September 2018

Property	Unit	EkaSol 1™	ZemaSol™	TergoSol™	KradaSol™	BerdeSol™	ShiraSol™	DMC	MEK	Acetone	Toluene	Xylene	TBAc	PCBTF	Heptane	Hexane	Mineral Spirits	Aromatic 100	Aromatic 150	MAK	n-butyl acetate
Boiling Point	°C	64.2	70	62	88	59	147.5	90	79.6	55	111	135	98	139	98.4	68	148	156	183.3	150	125
	°F	147.6	158	143.6	190.4	138.2	297.5	194	175.28	131	231.8	275	208.4	282.2	209.12	154.4	298.4	312.8	362	302	257
ER (nBuAc = 1)		3.62	5.14	5.35	1.4	2.5	0.1	3.2	3.8	6.4	1.6	0.7	2.8	0.9	3	8.3	0.13	0.29	0.06	0.4	1
Flash Point	°C	5	4	4.5	20.7	5.37	43.5	17	-8.89	-20	6.7	28.3	4.44	43	-4	-26	38	42.2	66	39	27.2
	°F	41	39.2	40.1	69.3	41.7	110	62.6	15.998	-4	44.06	82.94	39.99	109.4	24.8	-14.8	100.4	107.96	150	102.2	80.96
KB value		79.1	90.3	54.7	49.2	51.34	54.5	N/A	N/A	N/A	105	98	114	64	25.4	26.5	33	93	97	N/A	N/A
HSP	$(Mpa)^{1/2}$	19.1	18.5	18.7	15.7	15.7	17.2	18.7	19.1	19.9	18.2	17.9	17.7	17.5	15.3	14.9	15.8	17.8	17.8	17.6	17.4
H-Bond	$(Mpa)^{1/2}$	8.5	7.2	8.1	3.1	3.6	3.4	9.7	5.1	7	2	3.1	6.2	4.7	0	0	0.2	0	1.4	4.1	6.4
Dipole	$(Mpa)^{1/2}$	6.4	7.6	6.3	5.7	4.5	8.3	3.9	9	10.4	1.4	1	6.2	9.9	0	0	0.1	1	0.6	5.7	3.7
Dispersion	$(Mpa)^{1/2}$	15.7	15.3	15.5	13.5	13.8	13.9	15.5	16	15.5	18	17.6	15.4	13.7	15.3	14.9	15.8	17.8	17.8	16.2	15.8
Hildebrand	$(Mpa)^{1/2}$	19.9	19.2	19.5	17.2	16.9	27.2	20.3	19.3	19.7	18.3	18.2	16.6	17.6	15.9	14.9	15.4	17.8	17.8	17.4	17.4
HSP	$(cal/cm^3)^{1/2}$	9.3	9.0	9.1	7.7	7.7	8.4	9.1	9.3	9.7	8.9	8.7	8.6	8.6	7.5	7.3	7.7	8.7	8.7	8.6	8.5
H-Bond	$(cal/cm^3)^{1/2}$	4.2	3.5	4.0	1.5	1.8	1.7	4.7	2.5	3.4	1.0	1.5	3.0	2.3	0	0	0.10	0	0.7	2	3.1
Dipole	$(cal/cm^3)^{1/2}$	3.1	3.7	3.1	2.8	2.2	4.0	1.9	4.4	5.1	0.7	0.5	3.0	4.8	0	0	0.05	0.49	0.3	2.8	1.8
Dispersion	$(cal/cm^3)^{1/2}$	7.7	7.5	7.6	6.6	6.7	6.8	7.6	7.8	7.6	8.8	8.6	7.5	6.7	7.5	7.3	7.7	8.7	8.7	7.9	7.7
Hildebrand	$(cal/cm^3)^{1/2}$	9.7	9.4	9.5	8.4	8.2	13.3	9.9	9.3	9.8	8.9	8.9	8.1	8.6	7.75	7.27	7.5	8.7	8.7	8.5	8.5
Surface Tension	dynes/cm	26.1	24.2	25.1	21.1	20.4	24.5	28.5	24.6	22.3	28.4	28.7	22.4	25	20.1	18.43	24.7	29	30	26.1	25.1
Specific Gravity	@ 20°C	0.97	1	0.97	1.07	0.94	1.2	1.07	0.802	0.792	0.87	0.87	0.86	1.34	0.681	0.66	0.79	0.88	0.895	0.818	0.88
MIR		0.47	0.079	0.065	0.0622	0.047	0.097	0.06	1.49	0.36	3.97	7.49	0.2	0.11	1.28	1.45	0.9-2.47	7.51	8.07	2.8	0.89
Vapour Pressure	torr @ 20°C	132.97	147.85	140.25	36.8	80.6	3.46	42	70.2	185	22	6.6	34	5.6	46	10	2.5	6	1	2.14	10
Viscosity	cP	0.86	0.44	0.89	0.69	0.58	1.18	0.625	0.43	0.36	0.55	0.81	1.2	0.79	0.42	0.31	1	0.9	0.9	0.81	0.74
VOC	g/l	2.66*	1.59*	2.82*	2.2*	0.9*	2.9*	0***	800	0**	870	870	0***	0**	680	660	760	869	891	810	880
Molecular Weight	g/mol	79.38	84.2	77.9	156	117.2	180.97	90.08	72.11	58.08	92.14	106.16	116.16	180.56	100.21	86.18	146	120	138	114.18	116.16
Heat of combustion																					
btu/lb		9205.2	8943.8	8583.8	9905.3	10898.0	8046.8	6820.5	13480.0	13218.8	17430.0	18435.4		7700.0	19170.0	20769.8	19346.5	18056.6	18056.6	-1762.0	13130.0
kcal/kg		5116.8	4971.3	4771.3	5506.3	6058.0	4473.2	3791.5	7493.5	7348.4	9689.3	10248.2		4280.4	10656.6	11545.9	10748.1	10031.5	10031.5	-979.8	7299.0
kJ/mol		1699.4	1751.4	1555.1	3594.0	2970.6	3387.0	1429.0	2260.9	1785.7	3735.4	4552.0		3233.7	4468.1	4163.2	6565.6	5036.6	5792.1	4102.2	3547.4
Heat of vaporization																					
btu/lb		176.9	156.8	175.6	98.9	121.6	97.8	179.9	191.0	229.4	174.0	150.0	140.6	89.2	136.1	157.4	111.8	139.7	126.8	148.9	133.0
cal/g		98.5	87.4	97.8	55.0	67.7	54.3	100.0	106.2	127.5	96.8	83.4	78.2	49.6	75.7	87.5	0.1	0.1	0.1	82.8	73.9
kJ/mol		32.7	30.8	31.9	35.4	32.7	41.1	37.7	34.8	31.0	37.3	37.0	38.0	37.5	31.7	31.6	29.6	0.0	0.0	39.5	35.9

* Considered 0 VOC in all states, except South Coast, Bay Area, and certain other California Air Quality Management Districts. In those jurisdictions, these solvents are considered Ultra Low VOC, consult your local California Air Quality Management District to inquire if SCAQMD air quality rules apply.

** Solvents considered exempt throughout the United States.

*** Solvents maybe considered exempt in certain jurisdictions, while considered VOC in many California Air Quality Districts and other jurisdictions. Please consult your local regional regulatory authority as to applicable VOC status in a particular area or region.

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Property	Unit	GlykoSol™	TreviSol™	Propylene Glycol	Dipropylene Glycol n-Butyl Ether (DPnP)	EASTMAN Texanol	EASTMAN OptiFilm Enhancer 300	EASTMAN OptiFilm Enhancer 400	EASTMAN EB	EASTMAN DM	EASTMAN EEP	EASTMAN PM	EASTMAN PM Acetate	DOW UCAR Filmer IBT	DOW Butyl Carbitol	DOW Carbitol
Boiling Point	°C	297	285	187	230	255	281	374	169	191	165	121	140	255	230	201
	°F	566.6	545	368.6	441	491	537.8	705.2	336	367	329	248	284	491	446	394
ER (nBuAc = 1)		0.01	0.0004	0.0157	0.006	0.002	0.0004	0.000017	0.09	0.02	0.12	0.7	0.39	<0.01	0.004	0.01
Flash Point	°C	146.1	143.3	103	100	122	290	380	62	88	58	33	45	118.89	114	90
	°F	295	290	217	212	251.6	554	716	143	191	136	91	114	246	237	194
KB value		94	70.5	27.5	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
HSP	$(Mpa)^{1/2}$			30.2	18.6	19	17	16.5	20.9	21.9	18.6	20.5	19.2	19.065	20.4	22.2
H-Bond	$(Mpa)^{1/2}$			23.3	9	9.8	6.8	5.7	12.3	12.7	8.8	11.7	9.8	9.84	10.6	12.2
Dipole	$(Mpa)^{1/2}$			9.4	5.5	6.1	2.3	3.5	5.1	7.8	3.3	6.3	5.5	6.15	7	9.2
Dispersion	$(Mpa)^{1/2}$			16.8	15.3	15.1	15.3	15.1	16	16.2	16.2	15.5	15.5	15.17	16	16.1
Hildebrand	$(Mpa)^{1/2}$			30.7	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	22.3	19.7
HSP	$(cal/cm^3)^{1/2}$			14.7	9.1	9.3	8.3	8.0	10.2	10.7	9.1	10.0	9.4	9.3	10.0	10.8
H-Bond	$(cal/cm^3)^{1/2}$			11.4	4.4	4.8	3.3	2.8	6.0	6.2	4.3	5.7	4.8	4.8	5.2	6.0
Dipole	$(cal/cm^3)^{1/2}$			4.6	2.7	3.0	1.1	1.7	2.5	3.8	1.6	3.1	2.7	3	3.4	4.5
Dispersion	$(cal/cm^3)^{1/2}$			8.2	7.5	7.4	7.5	7.4	7.8	7.9	7.9	7.6	7.6	7.4	7.8	7.9
Hildebrand	$(cal/cm^3)^{1/2}$			14.8	28.3	28.9	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	10.9	9.6
Surface Tension	dynes/cm			27.5	28.4	28.9	27.6	31.1	26.6	34.8	27.0	28.3	26.4	30.7	30.0	31.7
Specific Gravity	@ 20°C	0.98	0.956	1.036	0.91	0.946	0.945	0.967	0.902	1.02	0.95	0.923	0.97	0.948	0.95	0.99
MIR		1.37	1.4	2.75	3.02	0.89	0.38	N/A	2.9	2.9	3.61	2.62	1.71	N/A	2.7	3.19
Vapor Pressure	torr @ 20°C	0.008	0.005	0.08	0.04	0.01	0.0007	<0.0001	0.6	0.2	1.5	8	2.8	<0.01	0.003	0.07
Viscosity	cP	0.6	0.58	58.1	4.4	13.5	9.0	15.8	6.4	3.9	1.2	1.9	1.1	17.9	6.0	4.5
VOC	g/l	*	*	1036**	910**	950**	942**	967**	902	1020	950	923	970	948	950**	990**
Molecular Weight	g/mol	262.3	290.4	76.09	190.28	216.3	286.46	405.28	118.17	120.15	146.19	90.1	132.2	216	162.2	134.2

* Applicable compounds are not VOCs under CARB 310 rules (LVP-VOC) as the boiling point is above 216°C cut-off and the vapor pressure is below 0.1 mm Hg.

** Applicable compounds maybe considered 0 VOC or LVOC in certain jurisdictions, while considered as VOC in other jurisdictions. Please consult your local regional regulatory authority as to applicable VOC status in a particular area or region.

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