GT076

GL Sciences Inc.

Analysis and Retention Index of 61 Components of Organic Solvents -Comparison between Columns

The retention index is a relatively representative index of the retention ratio of straight-chain alkanes and is used to study constituents based on the number of carbons in the molecule. It is one of the most useful pieces of information for qualitative analysis.

The retention index can be determined because in isothermal analysis the logarithm of the retention ratio for straight-chain alkanes is linearly related to the number of carbons, and the retention ratio is also linear to the number of carbons in thermal rise analysis.

In this application note, we summarize the temperature rise analysis of 61 organic solvents and the retention index and retention time data for eight different columns with different liquid phases.

Columns

Column name	Liquid-phase	REFERENCE TECHNICAL NOTES
InertCap 1	100 % Methylpolysiloxane	No.53
InertCap 5	5 % Phenyl 95 % Methylpolysiloxane	No.63
InertCap 1301	6 % Cyanopropylphenyl 94 % Methylpolysiloxane	No.75
InertCap 25	25 % Phenyl 75 % Methylpolysiloxane	No.74
InertCap 1701	14 % Cyanopropylphenyl 86 % Methylpolysiloxane	No.71
InertCap 17	50 % Phenyl 50 % Methylpolysiloxane	No.64
InertCap Pure-WAX	Polyethylene Glycol	No.52
InertCap WAX	Polyethylene Glycol	No.65

Conditions

System : GC - FID
Column Size : 0.25 mm I.D. x 60 m df = 0.25 µm
Carrier Gas : He
Injection : 240 ˚C
Detection : FID Range 10^0
240 ˚C

Calculation of retention indices

In the case of temperature programming...

Because the retention ratio of straight-chain alkanes is linearly related to the number of carbons, the retention index is given by the following equation.

$$\text{Retention index I} = 100 \times \frac{TR - tR(Z)}{TR(Z+1) - tR(Z)} + 100 \times Z$$

And for isothermal analysis...

Because the logarithm of the retention ratio of straight-chain alkanes is linearly related to the number of carbons, the retention index is given by the following equation.

$$\text{Retention index I} = 100 \times \frac{\text{Log } t'R - \log t'R(Z)}{\text{Log } t'R(Z+1) - \log t'R(Z)} + 100 \times Z$$

T R = retention time of the target component
T R(Z) = retention time of straight-chain alkanes that precede the components of interest
T R(Z+1) = retention time of straight-chain alkanes emerging after the components of interest

Z = number of carbons in straight-chain alkanes with a retention time t R(Z)
T'R = corrected retention time t'R = t R-t 0
T 0 = hold-up time (elution time of non-retained components)

Retention Index in Temperature-Rise Analysis-1

Column name / Component	InertCap 1		InertCap 5		InertCap 1301		InertCap 25		InertCap 1701		InertCap 17		InertCap Pure-WAX		InertCap WAX	
	Retention index	Retention time	Retention index	Retention time	Retention index	Retention time	Retention index	Retention time	Retention index	Retention time	Retention index	Retention time	Retention index	Retention time	Retention index	Retention time
Acetone	460	5.218	487	5.176	525	6.052	548	5.985	581	6.269	617	5.941	808	5.785	820	6.632
Acetonitrile	445	5.154	484	5.164	540	6.202	580	6.219	620	6.867	658	6.408	996	8.455	1016	10.425
Benzene	645	7.034	659	7.323	679	8.210	714	8.222	714	8.595	768	8.259	936	7.401	949	8.862
Tert-Butanol	506	5.438	517	5.399	560	6.388	556	6.045	614	6.697	607	5.829	888	6.648	903	7.838
1-Butanol	639	6.923	656	7.268	712	8.924	712	8.163	769	10.103	764	8.183	1126	11.723	1142	14.145
2-Butanol	579	6.085	600	6.217	639	7.483	639	6.955	699	8.202	693	6.858	1011	8.791	1025	10.659
2-Butanone(MEK)	567	5.978	596	6.169	629	7.302	654	7.186	685	7.958	720	7.281	895	6.721	908	7.954
2-Butoxyethanol (Butyl cellosolve)	886	13.330	906	14.577	949	16.577	966	15.963	1009	18.263	1030	16.127	1388	19.346	1394	22.259
N-Butyl acetate	795	10.407	756	9.679	838	12.669	867	12.525	879	13.623	919	12.471	1064	10.091	1078	12.138
Carbon disulfide	527	5.623	598	6.198	542	6.215	590	6.298	562	6.098	633	6.118	727	5.276	735	5.813
Carbon tetrachloride	651	7.133	660	7.343	668	8.017	703	7.950	691	8.059	740	7.697	874	6.493	885	7.576
Chlorobenzene	829	11.503	848	12.583	871	13.830	916	14.194	917	14.918	987	14.649	1207	13.993	1219	16.686
Chloroform	601	6.289	615	6.499	646	7.603	672	7.452	695	8.138	725	7.382	1013	8.833	1027	10.719
o-Cresol	1026	18.193	1052	19.843	1156	23.844	1141	22.385	1265	26.903	1252	23.627	1977	34.454	2029	38.084
P-Cresol	1046	18.895	1071	20.515	1184	24.789	1164	23.078	1301	28.028	1276	24.380	2057	36.214	2112	40.101
m-Cresol	1047	18.932	1072	20.548	1186	24.838	1165	23.113	1303	28.086	1277	24.410	2065	36.388	2121	40.316
Cyclohexanol	862	12.561	885	13.853	934	16.047	958	15.663	1002	17.983	1033	16.247	1387	19.323	1395	22.293
Cyclohexanone	861	12.542	897	14.253	945	16.429	995	16.991	1021	18.768	1089	18.200	1286	16.290	1301	19.292
1,2-Dichlorobenzene	1016	17.847	1042	19.492	1072	20.966	1118	21.683	1128	22.623	1216	22.546	1483	22.010	1503	25.268
1,2-Dichloroethane	622	6.638	644	7.039	678	8.193	721	8.387	729	9.023	785	8.599	1055	9.889	1077	12.087
Cis-1,2-Dichloroethylene	589	6.172	607	6.353	630	7.316	661	7.281	672	7.728	717	7.280	983	8.224	1000	9.967
Trans-1,2-Dichloroethylene	546	5.790	557	5.787	576	6.544	609	6.502	607	6.574	644	6.249	849	6.225	861	7.218
Dichloromethane	512	5.488	526	5.485	555	6.339	594	6.323	604	6.520	635	6.193	921	7.143	935	8.549
Diethyl ether	497	5.369	504	5.270	511	5.918	523	5.802	523	5.737	550	5.511	616	4.874	616	5.189
N,N-Dimethylacetamide	826	11.407	872	13.398	944	16.372	981	16.487	1039	19.450	1100	18.581	1389	19.380	1406	22.614
N,N-Dimethylformamide	735	8.861	782	10.401	853	13.196	895	13.448	952	16.205	1012	15.502	1313	17.088	1333	20.310
1,4-Dioxane	683	7.676	708	8.308	732	9.474	779	9.823	783	10.491	855	10.478	1051	9.790	1072	11.967
Ethanol	426	5.077	440	4.968	500	5.819	498	5.623	548	5.968	541	5.415	920	7.121	935	8.549
2-Ethoxyethanol (Cellosolve)	691	7.801	711	8.401	752	10.032	769	9.588	815	11.445	835	9.898	1207	13.977	1219	16.670
2-Ethoxyethyl acetate (Cellosolve acetate)	877	13.056	905	14.545	939	16.226	984	16.617	997	17.802	1063	17.297	1281	16.157	1289	18.898

* Retention time in minutes

Retention Index in Temperature-Rise Analysis-1

Column name / Component	InertCap 1		InertCap 5		InertCap 1301		InertCap 25		InertCap 1701		InertCap 17		InertCap Pure-WAX		InertCap WAX	
	Retention index	Retention time	Retention index	Retention time	Retention index	Retention time	Retention index	Retention time	Retention index	Retention time	Retention index	Retention time	Retention index	Retention time	Retention index	Retention time
Ethyl acetate	595	6.229	612	6.428	633	7.378	662	7.300	674	7.768	719	7.274	879	6.550	893	7.676
Ethylbenzene	848	12.113	864	13.110	882	14.173	918	14.265	917	14.935	977	14.338	1121	11.568	1135	13.922
n-Hexane	600	6.271	599	6.207	600	6.773	600	6.377	599	6.440	600	5.787	603	4.838	599	5.122
2-Hexanone(MBK)	763	9.601	787	10.564	827	12.291	851	12.005	881	13.684	912	12.149	1071	10.268	1089	12.434
Isobutyl acetate	739	8.975	813	11.356	799	11.353	822	11.083	836	12.174	870	10.967	982	8.201	1018	10.468
Isopentyl acetate (Isoamyl acetate)	857	12.386	875	13.501	902	14.871	927	14.588	941	15.809	978	14.353	1115	11.400	1126	13.612
Isopropyl acetate	639	6.936	657	7.269	684	8.297	709	8.088	720	8.753	753	7.960	893	6.705	903	7.862
Methanol	357	4.893	380	4.752	421	5.473	418	5.362	481	5.437	466	5.108	882	6.583	902	7.821
2-Methoxyethanol (Methyl cellosolve)	610	6.446	629	6.759	676	8.164	697	7.824	740	9.325	762	8.127	1160	12.670	1179	15.394
Methyl acetate	509	5.463	522	5.453	547	6.268	581	6.227	595	6.399	634	6.128	820	5.910	831	6.784
3-Methyl-1-butanol (Isoamyl alcohol)	715	8.343	730	8.938	783	10.897	781	9.894	841	12.333	832	9.822	1191	13.532	1201	16.108
2-Methyl-1-propanol (Isobutyl alcohol)	608	6.412	622	6.616	672	8.090	667	7.376	730	9.043	719	7.274	1073	10.330	1093	12.526
4-Methyl-2-pentanone (MIBK)	717	8.408	736	9.117	775	10.672	798	10.302	826	11.831	849	10.302	1003	8.588	1014	10.366
4-Methylcyclohexanol	926	14.695	897	14.149	939	16.201	960	15.747	997	17.823	1025	15.969	1311	17.045	1321	19.938
4-Methylcyclohexanone	927	14.745	960	16.550	1010	18.782	1051	19.187	1079	21.003	1143	20.091	1333	17.698	1349	20.810
1-Pentanol (Amyl alcohol)	745	9.118	763	9.856	815	11.897	818	10.926	874	13.448	871	10.941	1233	14.762	1243	17.441
n-Pentyl acetate	894	13.592	912	14.813	939	16.207	968	16.021	980	17.207	1022	15.865	1164	12.775	1173	15.172
Phenol	952	15.638	976	17.128	1098	21.885	1059	19.527	1214	25.276	1167	20.928	1980	34.518	2036	38.256
1-Propanol	532	5.670	549	5.712	606	6.886	605	6.448	660	7.517	655	6.374	1022	9.069	1039	11.054
2-Propanol (Isopropyl alcohol)	471	5.264	491	5.192	532	6.125	530	5.853	593	6.382	585	5.704	914	7.021	927	8.381
n-Propyl acetate	695	7.868	712	8.425	736	9.586	764	9.464	777	10.317	820	9.468	967	7.943	979	9.525
Styrene	875	12.970	894	14.154	918	15.442	960	15.767	963	16.584	1034	16.260	1249	15.229	1263	18.070
1,1,2,2-Tetrachloroethane	879	13.103	913	14.826	966	17.165	1007	17.441	1038	19.428	1092	18.281	1492	22.247	1502	25.248
Tetrachloroethylene	802	10.608	813	11.350	819	12.037	855	12.160	842	12.371	906	11.967	1016	8.928	1029	10.779
Tetrahydrofuran	611	6.465	627	6.713	645	7.598	683	7.617	687	7.985	742	7.741	855	6.290	866	7.293
Toluene	752	9.313	767	9.974	786	10.982	820	11.017	820	11.635	877	11.099	1034	9.366	1050	11.348
1,1,1-Trichloroethane	630	6.783	643	7.008	658	7.825	691	7.732	689	8.023	730	7.487	876	6.520	888	7.613
Trichloroethylene	685	7.711	701	8.121	715	9.017	746	9.003	743	9.397	799	8.875	987	8.303	1001	10.020
o-Xylene	880	13.146	897	14.254	917	15.407	955	15.567	955	16.301	1019	15.757	1178	13.168	1190	15.730
o-Xylene	858	12.423	872	13.400	891	14.481	924	14.476	924	15.202	981	14.466	1128	11.773	1143	14.168
m-Xylene	857	12.387	871	13.378	890	14.467	925	14.500	925	15.208	983	14.539	1135	11.952	1149	14.375

* Retention time in minutes

Retention index (40 ℃)-1 in isothermal analysis

Column name / Component	InertCap 1		InertCap 5		InertCap 1301		InertCap 25		InertCap 1701		InertCap 17		InertCap Pure-WAX		InertCap WAX	
	Retention index	Retention time	Retention index	Retention time	Retention index	Retention time	Retention index	Retention time	Retention index	Retention time	Retention index	Retention time	Retention index	Retention time	Retention index	Retention time
Acetone	468	5.227	496	5.283	534	6.209	560	6.173	589	6.698	621	6.172	809	6.279	823	7.274
Acetonitrile	454	5.135	493	5.258	551	6.424	586	6.512	625	7.493	666	6.929	991	12.802	1011	16.613
Benzene	646	8.386	664	8.645	680	9.848	713	10.030	712	11.025	769	10.387	933	9.573	945	11.690
Tert-Butanol	510	5.565	529	5.602	572	6.738	567	6.265	625	7.491	611	6.041	896	8.235	907	9.752
1-Butanol	646	8.370	670	8.874	719	11.978	716	10.163	779	16.403	772	10.544	1132	31.393	1146	40.928
2-Butanol	586	6.662	605	6.856	650	8.653	648	7.725	706	10.586	698	7.739	1017	14.773	1030	18.557
2-Butanone(MEK)	575	6.442	600	6.731	636	8.215	663	8.122	689	9.761	725	8.575	892	8.118	905	9.708
2-Butoxyethanol (Butyl cellosolve)	886	39.361	911	46.973	949	63.703	963	57.064	-	-	1030	65.385	-	-	-	-
n-Butyl acetate	795	19.963	764	15.219	843	27.103	872	27.313	882	34.650	927	17.874	1064	19.730	1078	25.039
Carbon disulfide	532	5.802	544	5.821	548	6.383	589	6.560	570	6.378	638	5.888	726	5.363	734	5.937
Carbon tetrachloride	651	8.565	665	8.677	671	9.446	700	9.456	689	9.841	742	9.171	875	7.628	885	8.953
Chlorobenzene	820	23.793	841	26.552	862	31.410	904	35.043	902	40.569	969	39.648	1184	46.110	1197	61.774
Chloroform	597	6.958	620	7.215	653	8.751	677	8.566	697	10.107	725	8.557	1013	14.477	1027	18.444
o-Cresol	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
P-Cresol	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
-Cresol	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cyclohexanol	858	31.546	886	38.149	933	55.886	949	50.887	-	-	1024	62.620	-	-	-	-
Cyclohexanone	852	30.084	890	39.466	931	54.974	980	65.905	999	90.342	1069	91.908	1240	70.549	1254	97.037
1,2-Dichlorobenzene	1000	97.202	-	-	-	-	1170	179.045	-	-	-	-	-	-	-	-
1,2-Dichloroethane	622	7.607	651	8.156	680	9.853	722	10.481	729	12.108	784	11.285	1056	18.792	1075	24.559
Cis-1,2-Dichloroethylene	587	6.748	610	6.968	636	8.198	666	8.231	677	9.195	718	8.343	984	12.313	998	15.572
Trans-1,2-Dichloroethylene	554	6.105	567	6.155	581	6.911	611	6.912	611	7.152	652	6.695	855	7.143	867	8.395
Dichloromethane	516	5.628	537	5.690	564	6.610	595	6.646	607	7.057	646	6.548	926	9.297	940	11.449
Diethyl ether	495	5.458	510	5.405	517	6.021	533	5.916	536	5.923	560	5.533	620	4.820	623	5.149
N,N-Dimethylacetamide	823	24.297	898	42.159	943	60.634	977	64.292	-	-	1156	147.858	-	-	-	-
N,N-Dimethylformamide	734	13.278	798	19.228	854	29.554	893	32.064	948	59.275	1024	62.048	1278	94.764	1296	135.198
1,4-Dioxane	682	9.910	711	10.989	733	13.005	779	14.348	782	16.718	859	17.707	1044	17.378	1062	22.597
Ethanol	438	5.038	459	5.032	506	5.918	502	5.682	565	6.301	555	5.493	926	9.318	941	11.387
2-Ethoxyethanol (Cellosolve)	691	10.378	720	11.551	757	14.947	772	13.742	817	21.161	840	15.567	1197	50.563	1210	68.302
2-Ethoxyethyl acetate (Cellosolve acetate)	886	39.208	917	49.315	949	63.843	996	75.925	-	-	1079	100.294	1281	96.976	1291	130.916

* Retention time in minutes

Retention index (40 ℃)-2 in isothermal analysis

Component \ Column name	InertCap 1		InertCap 5		InertCap 1301		InertCap 25		InertCap 1701		InertCap 17		InertCap Pure-WAX		InertCap WAX	
	Retention index	Retention time	Retention index	Retention time	Retention index	Retention time	Retention index	Retention time	Retention index	Retention time	Retention index	Retention time	Retention index	Retention time	Retention index	Retention time
Ethyl acetate	599	6.938	619	7.182	642	8.397	671	8.374	682	9.441	723	8.489	882	7.828	893	9.244
Ethylbenzene	841	27.727	857	30.202	874	34.490	909	36.454	906	42.059	964	38.328	1106	26.265	1119	34.016
n-Hexane	600	6.962	600	6.743	600	7.288	601	6.741	601	6.952	593	5.864	601	4.762	600	5.102
2-Hexanone(MBK)	764	16.055	792	18.424	828	24.313	853	23.747	880	33.943	915	26.239	1066	20.005	1083	25.777
Isobutyl acetate	743	14.022	819	22.421	802	20.205	827	19.633	840	25.025	877	28.788	982	12.149	1017	17.283
Isopentyl acetate (Isoamyl acetate)	860	32.093	881	36.514	905	44.145	932	43.960	943	56.978	983	44.553	1112	27.306	1122	34.836
Isopropyl acetate	646	8.385	668	8.792	689	10.298	713	10.031	725	11.814	765	10.272	895	8.193	904	9.663
Methanol	379	4.802	397	4.749	440	5.472	436	5.358	497	5.553	485	5.095	887	7.963	903	9.590
2-Methoxyethanol (Methyl cellosolve)	611	7.302	641	7.817	681	9.914	697	9.309	746	13.233	772	10.599	1151	36.154	1169	49.163
Methyl acetate	514	5.606	534	5.656	558	6.527	587	6.527	599	6.905	643	6.498	824	6.528	837	7.522
3-Methyl-1-butanol (Isoamyl alcohol)	717	12.018	741	13.103	791	18.697	785	14.919	851	27.188	840	15.623	1194	49.562	1204	65.220
2-Methyl-1-propanol (Isobutyl alcohol)	610	7.286	633	7.566	682	9.945	675	8.511	741	12.847	722	8.477	1081	22.104	1098	28.408
4-Methyl-2-pentanone (MIBK)	717	11.978	743	13.262	778	17.087	798	16.212	826	22.571	855	17.188	996	13.139	1009	16.445
4-Methylcyclohexanol	920	51.823	891	39.810	934	56.509	951	51.507	993	86.396	1016	58.325	1297	109.952	-	-
4-Methylcyclohexanone	913	49.182	950	65.552	992	92.138	1051	108.532	-	-	1148	144.450	1281	96.647	1293	132.801
1-Pentanol (Amyl alcohol)	749	14.625	773	16.217	824	23.509	821	18.811	884	35.199	880	20.404	1235	67.991	1245	90.214
n-Pentyl acetate	898	43.360	919	50.144	943	60.782	973	62.368	983	79.227	1028	64.789	1160	38.651	1170	50.041
Phenol	969	79.566	992	94.428	-	-	1084	134.571	-	-	-	-	-	-	-	-
1-Propanol	544	5.956	564	6.059	612	7.554	609	6.873	674	9.075	664	6.921	1029	15.838	1044	20.178
2-Propanol (Isopropyl alcohol)	478	5.307	501	5.323	545	6.344	542	5.991	602	6.953	591	5.808	922	9.144	934	11.023
n-Propyl acetate	695	10.629	718	11.463	742	13.710	771	13.633	781	16.617	826	14.377	969	11.372	980	13.977
Styrene	866	33.712	885	37.885	908	45.313	948	50.395	949	59.477	1016	58.413	1225	63.008	1238	85.588
1,1,2,2-Tetrachloroethane	872	35.111	907	45.505	961	70.865	998	77.265	-	-	1075	96.316	-	-	-	-
Tetrachloroethylene	795	19.456	807	20.508	813	21.793	848	22.832	834	24.068	894	22.560	1009	14.099	1021	17.662
Tetrahydrofuran	610	7.279	635	7.632	651	8.688	685	8.857	687	9.760	752	9.639	854	7.108	866	8.348
Toluene	748	14.526	766	15.407	783	17.695	816	18.158	815	20.858	870	19.121	1025	15.536	1040	19.755
1,1,1-Trichloroethane	631	7.877	648	8.069	662	9.088	690	9.056	688	9.787	732	8.816	876	7.648	886	8.984
Trichloroethylene	682	9.933	700	10.329	714	11.701	747	11.886	743	13.109	795	11.890	985	12.358	997	15.381
o-Xylene	871	34.864	887	38.477	906	44.623	942	47.703	941	55.464	1001	51.487	1156	37.532	1169	49.865
p-Xylene	851	29.898	866	32.305	883	36.970	915	38.242	914	44.449	968	39.443	1112	27.432	1126	35.768
m-Xylene	850	29.646	865	32.134	882	36.857	915	38.403	914	44.848	970	39.928	1118	28.563	1131	37.315

* Retention time in minutes

Retention index (80 ℃)-1 in isothermal analysis

Component \ Column name	InertCap 1		InertCap 5		InertCap 1301		InertCap 25		InertCap 1701		InertCap 17		InertCap Pure-WAX		InertCap WAX	
	Retention index	Retention time	Retention index	Retention time	Retention index	Retention time	Retention index	Retention time	Retention index	Retention time	Retention index	Retention time	Retention index	Retention time	Retention index	Retention time
Acetone	463	5.187	494	4.523	534	5.138	556	5.679	590	5.102	612	4.883	816	5.401	829	5.192
Acetonitrile	449	5.156	492	4.517	551	5.195	584	5.780	630	5.316	664	5.080	1004	6.873	1024	7.056
Benzene	659	6.155	673	5.388	689	6.048	723	6.724	724	6.141	782	5.955	951	6.263	964	6.224
Tert-Butanol	508	5.295	523	4.598	562	5.235	561	5.696	612	5.211	597	4.838	883	5.736	893	5.573
1-Butanol	643	6.018	660	5.277	706	6.229	711	6.593	768	6.762	769	5.830	1130	9.559	1144	10.169
2-Butanol	582	5.598	599	4.890	639	5.637	643	6.066	694	5.816	692	5.221	1010	6.962	1023	7.037
2-Butanone(MEK)	575	5.560	597	4.883	635	5.611	660	6.171	691	5.788	724	5.451	902	5.863	915	5.746
2-Butoxyethanol (Butyl cellosolve)	887	11.623	907	10.837	949	13.613	966	14.148	1010	17.638	1031	13.333	1385	29.795	1394	34.407
n-Butyl acetate	794	8.313	758	6.411	838	8.690	866	9.504	881	9.649	921	8.459	1071	8.018	1082	8.227
Carbon disulfide	541	5.408	557	4.702	563	5.240	589	5.800	588	5.093	665	5.056	748	5.178	758	4.916
Carbon tetrachloride	664	6.205	674	5.399	680	5.963	711	6.596	701	5.888	755	5.668	885	5.750	895	5.583
Chlorobenzene	835	9.495	855	8.704	876	9.945	919	11.554	919	11.311	989	11.026	1211	12.872	1224	14.194
Chloroform	605	5.743	624	5.031	654	5.744	681	6.326	701	5.880	736	5.540	1017	7.068	1031	7.178
o-Cresol	1029	23.716	1056	23.918	1164	46.904	1140	37.316	1272	89.957	-	-	-	-	-	-
P-Cresol	1049	26.618	1075	26.747	1195	57.523	1161	42.598	1311	116.593	-	-	-	-	-	-
m-Cresol	1050	26.792	1076	26.923	1197	58.137	1162	42.872	1313	118.129	-	-	-	-	-	-
Cyclohexanol	865	10.618	888	9.964	934	12.692	958	13.629	1001	16.847	1034	13.511	1384	29.637	1394	34.468
Cyclohexanone	866	10.667	900	10.480	945	13.365	993	16.134	1017	18.360	1087	17.634	1282	17.499	1296	20.033
1,2-Dichlorobenzene	1010	21.349	1035	21.129	1062	25.019	1115	31.840	1114	32.368	-	-	1458	44.486	1476	52.969
1,2-Dichloroethane	632	5.931	657	5.252	686	6.022	728	6.777	740	6.347	794	6.093	1064	7.879	1081	8.218
Cis-1,2-Dichloroethylene	595	5.683	615	4.974	639	5.639	671	6.249	684	5.716	727	5.441	988	6.673	1003	6.726
Trans-1,2-Dichloroethylene	557	5.478	570	4.752	585	5.333	614	5.909	616	5.234	659	5.056	858	5.592	868	5.402
Dichloromethane	518	5.328	540	4.648	566	5.252	598	5.835	612	5.213	650	5.019	925	6.034	939	5.956
Diethyl ether	490	5.255	506	4.552	514	5.082	528	5.601	533	4.888	549	4.722	622	4.958	619	4.638
N,N-Dimethylacetamide	829	9.312	875	9.421	943	13.278	980	15.137	1045	21.483	1119	20.350	1378	28.655	1394	34.360
N,N-Dimethylformamide	740	7.198	784	6.887	856	9.231	896	10.542	956	13.376	1020	12.614	1308	19.900	1328	23.693
1,4-Dioxane	690	6.482	713	5.787	738	6.627	784	7.559	790	7.167	863	7.142	1064	7.885	1081	8.212
Ethanol	423	5.109	442	4.422	494	5.029	496	5.529	552	4.951	537	4.701	919	5.987	933	5.905
2-Ethoxyethanol (Cellosolve)	693	6.521	713	5.794	755	6.873	773	7.375	817	7.749	840	6.695	1211	12.830	1225	14.230
2-Ethoxyethyl acetate (Cellosolve acetate)	878	11.170	905	10.708	939	13.012	984	15.435	999	16.636	1066	15.832	1284	17.698	1295	19.867

* Retention time in minutes

Retention index (80 ℃)-2 in isothermal analysis

Component \ Column name	InertCap 1		InertCap 5		InertCap 1301		InertCap 25		InertCap 1701		InertCap 17		InertCap Pure-WAX		InertCap WAX	
	Retention index	Retention time	Retention index	Retention time	Retention index	Retention time	Retention index	Retention time	Retention index	Retention time	Retention index	Retention time	Retention index	Retention time	Retention index	Retention time
Ethyl acetate	593	5.663	612	4.960	636	5.618	664	6.198	679	5.673	720	5.426	884	5.744	894	5.582
Ethylbenzene	853	10.132	868	9.173	884	10.288	921	11.615	919	11.313	980	10.601	1131	9.574	1143	10.110
n-Hexane	600	5.703	602	4.904	600	5.408	599	5.840	602	5.162	599	4.843	602	4.936	597	4.613
2-Hexanone(MBK)	768	7.718	790	7.001	828	8.418	852	9.077	883	9.762	913	8.260	1080	8.220	1094	8.543
Isobutyl acetate	742	7.227	812	7.502	798	7.676	821	8.294	838	8.283	871	7.242	985	6.641	1021	7.011
Isopentyl acetate (Isoamyl acetate)	858	10.344	875	9.453	901	11.019	927	11.919	943	12.576	978	10.534	1120	9.254	1130	9.646
Isopropyl acetate	644	6.029	660	5.274	683	5.989	705	6.538	721	6.109	755	5.696	895	5.811	904	5.651
Methanol	369	5.017	368	4.334	429	4.903	428	5.421	486	4.768	469	4.561	881	5.727	899	5.616
2-Methoxyethanol (Methyl cellosolve)	615	5.808	636	5.105	680	5.960	698	6.474	747	6.440	772	5.858	1167	10.851	1184	11.947
Methyl acetate	510	5.303	530	4.618	554	5.208	582	5.770	601	5.157	635	4.960	826	5.441	838	5.232
3-Methyl-1-butanol (Isoamyl alcohol)	715	6.812	732	6.028	780	7.306	782	7.520	840	8.336	835	6.627	1195	12.038	1206	13.092
2-Methyl-1-propanol (Isobutyl alcohol)	608	5.764	624	5.030	669	5.868	670	6.241	728	6.193	723	5.443	1077	8.148	1091	8.464
4-Methyl-2-pentanone (MIBK)	722	6.903	741	6.160	778	7.276	797	7.800	830	8.056	852	6.913	1009	6.951	1021	7.014
4-Methylcyclohexanol	926	13.828	899	10.436	938	12.954	961	13.805	997	16.451	1026	13.012	1311	20.213	1322	22.918
4-Methylcyclohexanone	928	13.933	960	13.994	1006	18.215	1051	21.915	1077	25.887	1155	23.493	1323	21.454	1336	24.760
1-Pentanol (Amyl alcohol)	747	7.311	764	6.516	812	7.994	817	8.196	873	9.387	874	7.328	1237	14.339	1248	15.847
n-Pentyl acetate	894	11.983	913	11.107	939	12.992	967	14.227	982	15.198	1023	12.813	1169	10.942	1178	11.614
Phenol	953	15.784	978	15.330	1107	32.758	1063	23.415	1223	64.848	1190	27.059	-	-	-	-
1-Propanol	537	5.394	555	4.699	599	5.402	602	5.855	660	5.521	656	5.043	1023	7.159	1038	7.311
2-Propanol (Isopropyl alcohol)	470	5.201	493	4.521	534	5.138	535	5.620	589	5.099	577	4.785	911	5.924	923	5.809
n-Propyl acetate	694	6.537	712	5.776	737	6.613	764	7.249	779	6.959	818	6.388	972	6.489	983	6.460
Styrene	878	11.191	897	10.336	919	11.867	961	13.837	963	13.858	1033	13.422	1251	15.223	1264	17.059
1,1,2,2-Tetrachloroethane	881	11.343	914	11.183	965	14.701	1006	17.193	1037	20.462	1088	17.763	1493	54.496	1516	65.713
Tetrachloroethylene	806	8.630	819	7.672	825	8.338	863	9.388	849	8.603	913	8.260	1029	7.245	1040	7.342
Tetrahydrofuran	619	5.839	638	5.114	656	5.763	690	6.404	697	5.843	755	5.693	874	5.681	885	5.512
Toluene	761	7.572	776	6.722	792	7.555	827	8.423	827	7.984	885	7.563	1048	7.568	1061	7.757
1,1,1-Trichloroethane	642	6.014	656	5.248	670	5.870	698	6.471	699	5.868	743	5.593	889	5.773	899	5.613
Trichloroethylene	693	6.519	707	5.727	722	6.412	756	7.123	754	6.537	807	6.252	995	6.757	1007	6.788
o-Xylene	883	11.439	899	10.470	918	11.824	956	13.524	956	13.369	1019	12.593	1185	11.598	1197	12.588
o-Xylene	862	10.495	876	9.481	893	10.633	926	11.889	926	11.676	983	10.759	1138	9.807	1150	10.403
m-Xylene	861	10.450	876	9.458	892	10.617	927	11.927	926	11.682	985	10.851	1144	10.014	1156	10.651

* Retention time in minutes

Retention index (120 ℃)-1 in isothermal analysis

Component \ Column name	InertCap 1		InertCap 5		InertCap 1301		InertCap 25		InertCap 1701		InertCap 17		InertCap Pure-WAX		InertCap WAX	
	Retention index	Retention time	Retention index	Retention time	Retention index	Retention time	Retention index	Retention time	Retention index	Retention time	Retention index	Retention time	Retention index	Retention time	Retention index	Retention time
Acetone	451	5.388	481	4.223	532	4.778	558	4.760	587	4.625	611	4.507	814	5.393	837	4.605
Acetonitrile	431	5.370	478	4.220	551	4.800	587	4.793	632	4.705	672	4.618	1011	5.873	1037	5.158
Benzene	664	5.778	679	4.536	698	5.108	739	5.095	734	4.983	797	4.903	965	5.713	982	4.945
Tert-Butanol	507	5.431	510	4.250	555	4.806	557	4.759	599	4.645	595	4.490	862	5.468	878	4.678
1-Butanol	636	5.696	652	4.469	699	5.102	712	5.019	760	5.083	768	4.817	1122	6.452	1139	5.755
2-Butanol	583	5.551	591	4.352	633	4.936	646	4.878	685	4.829	691	4.617	997	5.818	1013	5.057
2-Butanone(MEK)	577	5.539	591	4.353	635	4.940	663	4.909	692	4.848	724	4.712	907	5.559	925	4.781
2-Butoxyethanol (Butyl cellosolve)	888	7.252	909	5.838	951	6.834	972	6.610	1015	7.516	1038	6.557	1397	10.655	1419	10.356
n-Butyl acetate	788	6.364	753	4.783	835	5.727	863	5.652	879	5.802	917	5.431	1072	6.148	1085	5.398
Carbon disulfide	556	5.499	595	4.359	575	4.843	604	4.814	597	4.641	682	4.619	765	5.330	788	4.537
Carbon tetrachloride	670	5.798	681	4.542	691	5.077	726	5.058	711	4.907	771	4.791	893	5.528	905	4.735
Chlorobenzene	847	6.822	868	5.463	891	6.172	938	6.250	937	6.383	1013	6.258	1236	7.526	1254	6.940
Chloroform	605	5.619	624	4.410	658	4.991	691	4.968	704	4.883	747	4.763	1015	5.888	1033	5.142
o-Cresol	1024	9.684	1052	8.152	1152	11.811	1156	10.607	1265	17.527	1255	12.084	1967	105.964	2006	121.239
p-Cresol	1043	10.188	1074	8.720	1181	13.116	1171	11.187	1302	20.613	1278	13.076	2035	147.323	2076	169.940
m-Cresol	1043	10.208	1075	8.737	1183	13.189	1172	11.223	1304	20.802	1279	13.122	2042	152.010	2083	175.611
Cyclohexanol	873	7.080	897	5.715	940	6.693	971	6.604	1008	7.400	1050	6.707	1396	10.629	1420	10.386
Cyclohexanone	879	7.152	913	5.881	961	6.968	1011	7.142	1038	7.977	1107	7.633	1319	8.812	1338	8.410
1,2-Dichlorobenzene	1029	9.797	1055	8.216	1082	9.430	1139	10.060	1140	10.839	1225	10.955	1495	14.203	1519	14.362
1,2-Dichloroethane	635	5.693	659	4.485	694	5.088	738	5.093	750	5.043	806	4.931	1070	6.139	1090	5.428
Cis-1,2-Dichloroethylene	598	5.603	613	4.390	645	4.960	681	4.947	689	4.840	737	4.708	991	5.798	1008	5.040
Trans-1,2-Dichloroethylene	564	5.513	568	4.318	589	4.855	624	4.843	617	4.676	665	4.575	854	5.456	870	4.662
Dichloromethane	523	5.451	537	4.210	569	4.825	606	4.817	613	4.668	660	4.568	921	5.593	940	4.819
Diethyl ether	475	5.411	490	4.231	510	4.754	529	4.733	523	4.543	547	4.448	616	5.215	620	4.398
N,N-Dimethylacetamide	834	6.708	876	5.525	948	6.790	988	6.813	1053	8.295	1112	7.728	1406	10.903	1436	10.892
N,N-Dimethylformamide	746	6.113	786	4.934	860	5.912	903	5.936	965	6.735	1024	6.383	1334	9.111	1359	8.908
1,4-Dioxane	693	5.879	715	4.645	745	5.260	793	5.288	798	5.266	873	5.204	1081	6.198	1100	5.486
Ethanol	351	5.346	427	4.184	485	4.731	495	4.707	536	4.557	546	4.479	903	5.551	923	4.777
2-Ethoxyethanol (Cellosolve)	691	5.871	711	4.630	755	5.302	778	5.228	820	5.383	847	5.086	1218	7.311	1237	6.718
2-Ethoxyethyl acetate (Cellosolve acetate)	869	7.044	896	5.712	932	6.594	976	6.662	993	7.146	1057	6.800	1282	8.163	1297	7.606

* Retention time in minutes

Maintenance Retention index (120 ℃)-2 in isothermal analysis

Column name	InertCap 1		InertCap 5		InertCap 1301		InertCap 25		InertCap 1701		InertCap 17		InertCap Pure-WAX		InertCap WAX	
Component	Retention index	Retention time	Retention index	Retention time	Retention index	Retention time	Retention index	Retention time	Retention index	Retention time	Retention index	Retention time	Retention index	Retention time	Retention index	Retention time
Ethyl acetate	590	5.568	600	4.368	632	4.933	662	4.908	673	4.798	713	4.657	880	5.502	894	4.711
Ethylbenzene	861	6.965	879	5.551	895	6.223	936	6.222	932	6.324	998	6.099	1151	6.668	1165	5.961
n-Hexane	600	5.591	594	4.358	599	4.873	605	4.815	598	4.643	600	4.495	600	5.208	600	4.388
2-Hexanone(MBK)	768	6.235	790	4.954	830	5.698	854	5.595	888	5.880	914	5.434	1088	6.240	1106	5.522
Isobutyl acetate	736	6.065	807	5.048	794	5.489	819	5.403	837	5.489	866	5.153	985	5.777	1023	5.099
Isopentyl acetate (Isoamyl acetate)	854	6.893	872	5.497	899	6.249	925	6.122	942	6.436	976	5.891	1124	6.465	1136	5.727
Isopropyl acetate	636	5.693	650	4.464	678	5.041	701	4.993	716	4.921	748	4.767	888	5.519	900	4.724
Methanol	353	5.300	354	4.146	414	4.681	428	4.667	466	4.489	486	4.440	866	5.477	890	4.702
2-Methoxyethanol (Methyl cellosolve)	612	5.636	632	4.427	682	5.051	706	5.004	750	5.042	778	4.845	1176	6.883	1199	6.277
Methyl acetate	509	5.433	516	4.256	551	4.801	582	4.787	591	4.632	634	4.533	822	5.405	839	4.608
3-Methyl-1-butanol (Isoamyl alcohol)	711	5.951	728	4.689	773	5.384	783	5.248	834	5.472	837	5.045	1188	6.993	1205	6.342
2-Methyl-1-propanol (Isobutyl alcohol)	601	5.609	615	4.394	663	5.002	672	4.927	720	4.933	722	4.708	1065	6.114	1082	5.384
4-Methyl-2-pentanone (MIBK)	721	5.998	742	4.738	780	5.416	800	5.318	834	5.473	854	5.118	1017	5.893	1032	5.135
4-Methylcyclohexanol	935	7.883	958	6.422	947	6.781	974	6.643	1005	7.351	1042	6.598	1322	8.870	1337	8.393
4-Methylcyclohexanone	937	7.999	975	6.671	1023	8.018	1068	8.184	1100	9.509	1155	8.752	1362	9.738	1378	9.415
1-Pentanol (Amyl alcohol)	742	6.094	760	4.814	805	5.547	817	5.397	867	5.705	875	5.213	1231	7.463	1248	6.858
n-Pentyl acetate	889	7.269	908	5.832	936	6.644	964	6.527	980	6.948	1019	6.329	1173	6.855	1185	6.142
Phenol	944	8.031	973	6.634	1088	9.636	1070	8.220	1213	14.209	1174	9.280	1963	103.939	2004	120.335
1-Propanol	536	5.468	543	4.285	591	4.858	605	4.815	649	4.740	658	4.598	1011	5.871	1030	5.126
2-Propanol (Isopropyl alcohol)	450	5.384	475	4.218	525	4.770	536	4.739	574	4.606	575	4.471	892	5.527	909	4.744
n-Propyl acetate	687	5.858	706	4.614	733	5.216	762	5.171	777	5.158	816	4.967	971	5.731	984	4.954
Styrene	887	7.248	908	5.828	931	6.586	977	6.675	977	6.906	1053	6.744	1273	8.023	1290	7.482
1,1,2,2-Tetrachloroethane	889	7.290	924	5.997	972	7.129	1018	7.248	1046	8.153	1105	7.582	1495	14.234	1519	14.362
Tetrachloroethylene	816	6.566	831	5.193	839	5.755	880	5.761	864	5.686	934	5.563	1046	6.020	1059	5.263
Tetrahydrofuran	622	5.658	638	4.439	664	5.005	701	4.992	704	4.884	763	4.803	887	5.517	903	4.729
Toluene	768	6.238	785	4.928	802	5.538	842	5.522	839	5.508	902	5.359	1066	6.117	1082	5.382
1,1,1-Trichloroethane	647	5.727	660	4.488	679	5.044	710	5.015	709	4.898	756	4.785	898	5.538	911	4.748
Trichloroethylene	697	5.898	713	4.636	730	5.205	768	5.192	763	5.098	822	4.986	1002	5.837	1016	5.071
o-Xylene	894	7.322	912	5.868	931	6.588	973	6.628	971	6.812	1040	6.583	1209	7.213	1225	6.567

* Retention time in minutes

Maintenance index (160 ℃)-1 in isothermal analysis

Column name
Component

* Retention time in minutes

Maintenance Retention index (160 ℃)-2 in isothermal analysis

Column name / Component	InertCap 1		InertCap 5		InertCap 1301		InertCap 25		InertCap 1701		InertCap 17		InertCap Pure-WAX		InertCap WAX	
	Retention index	Retention time	Retention index	Retention time	Retention index	Retention time	Retention index	Retention time	Retention index	Retention time	Retention index	Retention time	Retention index	Retention time	Retention index	Retention time
Ethyl acetate	586	5.705	598	4.058	625	4.531	650	4.543	670	4.361	709	4.289	875	5.600	891	4.301
Ethylbenzene	873	6.285	885	4.477	907	4.993	952	5.015	947	4.902	1018	4.783	1172	6.077	1185	4.728
N-Hexane	600	5.719	602	4.063	596	4.510	602	4.502	597	4.301	602	4.225	600	5.466	608	4.192
2-Hexanone(MBK)	770	5.996	784	4.265	833	4.808	856	4.788	892	4.734	908	4.563	1098	5.901	1109	4.555
Isobutyl acetate	733	5.920	796	4.285	791	4.729	814	4.717	835	4.598	907	4.560	981	5.712	1032	4.468
Isopentyl acetate (Isoamyl acetate)	853	6.217	865	4.426	898	4.965	923	4.937	943	4.886	973	4.702	1125	5.958	1144	4.665
Isopropyl acetate	630	5.768	648	4.095	672	4.572	690	4.574	710	4.403	740	4.313	884	5.608	897	4.306
Methanol	345	5.571	347	3.915	400	4.418	405	4.441	473	4.234	492	4.188	855	5.583	879	4.292
2-Methoxyethanol (Methyl cellosolve)	614	5.752	640	4.088	682	4.583	706	4.588	753	4.458	761	4.368	1183	6.109	1212	4.823
Methyl acetate	506	5.643	519	3.972	541	4.477	567	4.495	593	4.298	630	4.238	826	5.559	844	4.268
3-Methyl-1-butanol (Isoamyl alcohol)	710	5.881	719	4.173	772	4.697	785	4.675	830	4.588	824	4.436	1180	6.101	1201	4.792
2-Methyl-1-propanol (Isobutyl alcohol)	600	5.737	623	4.075	657	4.558	666	4.555	714	4.408	722	4.296	1052	5.815	1079	4.522
4-Methyl-2-pentanone (MIBK)	724	5.904	734	4.192	782	4.714	804	4.702	837	4.603	842	4.459	1025	5.773	1044	4.467
4-Methylcyclohexanol	947	6.600	924	4.588	959	5.164	991	5.142	1018	5.193	1062	4.928	1334	6.722	1353	5.368
4-Methylcyclohexanone	960	6.664	991	4.841	1044	5.547	1089	5.591	1125	5.852	1184	5.528	1402	7.148	1422	5.810
1-Pentanol (Amyl alcohol)	741	5.935	750	4.213	802	4.748	817	4.722	863	4.659	866	4.493	1224	6.238	1237	4.882
n-Pentyl acetate	887	6.336	905	4.531	933	5.074	962	5.047	980	5.023	1018	4.824	1174	6.083	1186	4.730
Phenol	943	6.581	975	4.771	1082	5.777	1083	5.555	1209	6.658	1198	5.688	1981	24.288	2026	23.851
1-Propanol	531	5.660	547	3.986	582	4.501	593	4.508	644	4.337	658	4.253	996	5.730	1026	4.442
2-Propanol (Isopropyl alcohol)	439	5.621	478	3.954	512	4.463	515	4.474	569	4.283	576	4.214	875	5.600	897	4.306
n-Propyl acetate	683	5.838	703	4.148	729	4.636	755	4.638	773	4.487	811	4.383	969	5.697	987	4.393
Styrene	899	6.385	920	4.577	943	5.108	994	5.155	994	5.082	1076	4.979	1295	6.523	1314	5.175
1,1,2,2-Tetrachloroethane	904	6.405	936	4.627	983	5.259	1033	5.310	1060	5.412	1126	5.202	1501	8.014	1513	6.693
Tetrachloroethylene	828	6.143	838	4.365	851	4.848	896	4.870	880	4.702	948	4.644	1065	5.837	1070	4.487
Tetrahydrofuran	627	5.766	630	4.086	668	4.569	703	4.586	713	4.407	748	4.356	900	5.625	920	4.325
Toluene	778	6.013	787	4.269	813	4.769	856	4.788	855	4.642	911	4.568	1083	5.870	1094	4.528
1,1,1-Trichloroethane	655	5.799	655	4.107	686	4.587	717	4.598	718	4.413	746	4.354	904	5.628		

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