

Date : April 26, 2018

CERTIFICATE OF ANALYSIS - GC PROFILING

SAMPLE IDENTIFICATION

Internal code : 18D17-PTH2-1-CC

Customer identification : Rhododendron - Nepal - RJ010072R

Type : Essential oil

Source : *Rhododendron anthopogon*

Customer : Plant Therapy

ANALYSIS

Method: PC-PA-014-17J19 - Analysis of the composition of an essential oil, or other volatile liquid, by FAST GC-FID (in French); identifications validated by GC-MS.

Analyst : Sylvain Mercier, M. Sc., Chimiste

Analysis date : April 23, 2018

Checked and approved by :

Alexis St-Gelais, M. Sc., chimiste 2013-174

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PHYSICOCHEMICAL DATA

Physical aspect: Faintly yellow liquid

Refractive index: 1.4813 ± 0.0003 (20 °C)

CONCLUSION

No adulterant, contaminant or diluent has been detected using this method.

ANALYSIS SUMMARY

Identification	DB-5 (%)	DB-WAX (%)	Classe
2-Methyl-3-buten-2-ol	tr	tr	Aliphatic alcohol
Toluene	tr	0.01	Simple phenolic
Octane	0.02	0.02	Alkane
5-Methyl-3-hexanone	0.04	0.04	Aliphatic ketone
4-Methyl-3-hexanone	0.02	0.03*	Aliphatic ketone
Ethyl 2-methylbutyrate	0.01	0.08*	Aliphatic ester
Ethyl isovalerate	0.01	[0.03]*	Aliphatic ester
Styrene	0.01	0.01	Simple phenolic
Bornylene	0.01*	tr	Monoterpene
Nonane	[0.01]*	tr	Alkane
Tricyclene	0.05	0.05	Monoterpene
α -Thujene	0.22	0.22	Monoterpene
α -Pinene	28.45	28.50	Monoterpene
Camphene	0.41*	0.30	Monoterpene
α -Fenchene	[0.41]*	[0.08]*	Monoterpene
Thuja-2,4(10)-diene	tr	0.15*	Monoterpene
6-Methyl-2-heptanone	tr	5.70*	Aliphatic ketone
β -Pinene	12.99*	12.92	Monoterpene
Sabinene	[12.99]*	[0.15]*	Monoterpene
Octen-3-ol	0.01	0.31*	Aliphatic alcohol
Myrcene	1.78	1.80	Monoterpene
α -Phellandrene	0.05	0.05	Monoterpene
Δ^3 -Carene	0.15	0.15	Monoterpene
α -Terpinene	0.17	0.18	Monoterpene
para-Cymene	0.69	0.69	Monoterpene
β -Phellandrene	9.98*	0.16	Monoterpene
1,8-Cineole	[9.98]*	0.02	Monoterpenic ether
Limonene	[9.98]*	9.86	Monoterpene
(Z)- β -Ocimene	5.03	[5.70]*	Monoterpene
2-Heptyl acetate	0.04	0.04	Aliphatic ester
(E)- β -Ocimene	0.95	0.96	Monoterpene
γ -Terpinene	2.02	1.43	Monoterpene
Octanol	0.01	0.01	Aliphatic alcohol
α -Pinene oxide analog	0.01	0.01	Monoterpenic ether
Terpinolene	0.42*	0.40	Monoterpene
para-Cymenene	[0.42]*	0.02	Monoterpene
Ethyl sorbate	0.04		Aliphatic ester
Linalool	0.30	0.29	Monoterpenic alcohol
endo-Fenchol	0.05	3.58*	Monoterpenic alcohol
Octen-3-yl acetate	0.01	0.01	Aliphatic ester
allo-Ocimene	0.12	0.11	Monoterpene
trans-Pinocarveol	0.04	0.62*	Monoterpenic alcohol
2-Octyl acetate	0.04		Aliphatic ester
Camphene hydrate	0.06	0.07	Monoterpenic alcohol
Borneol	0.04	0.63*	Monoterpenic alcohol
Ethyl benzoate	0.01	0.21*	Phenolic ester
Terpinen-4-ol	0.26	0.74*	Monoterpenic alcohol
para-Cymen-8-ol	0.02	0.01	Monoterpenic alcohol

α -Terpineol	0.40	[0.63]*	Monoterpenic alcohol
Methyl salicylate	0.02*	0.21*	Phenolic ester
Myrtenol	[0.02]*	0.01	Monoterpenic alcohol
(3Z,5E)-2,6-Dimethylocta-3,5,7-trien-2-ol?	0.03	0.27	Monoterpenic alcohol
(3E,5E)-2,6-Dimethylocta-3,5,7-trien-2-ol	0.06	0.06	Monoterpenic alcohol
<i>trans</i> -Carveol	0.01	0.01	Monoterpenic alcohol
Citronellol	0.03	0.41*	Monoterpenic alcohol
2-Nonyl acetate	0.02		Aliphatic ester
Unknown	0.04		Unknown
<i>trans</i> -Ascaridole glycol	0.01	0.01	Monoterpenic alcohol
Unknown	0.01	0.15*	Oxygenated monoterpene
Bornyl acetate	0.17	0.17	Monoterpenic ester
2-Undecanone	0.02	0.06	Aliphatic ketone
Bicycloelemene	0.03	0.04	Sesquiterpene
α -Cubebene	0.36	[0.31]*	Sesquiterpene
Unknown	0.04		Sesquiterpene
Citronellyl acetate	0.20	0.20	Monoterpenic ester
Cyclosativene I	0.01	0.01	Sesquiterpene
Cyclosativene II	0.01	0.02	Sesquiterpene
α -Ylangene	0.13	0.12	Sesquiterpene
α -Copaene	0.85	0.85	Sesquiterpene
β -Bourbonene	0.23	0.22	Sesquiterpene
β -Elemene	0.25	[3.58]*	Sesquiterpene
α -Funebrene	0.08*	0.05	Sesquiterpene
7-epi-Sesquithujene	[0.08]*	0.05	Sesquiterpene
α -Gurjunene	0.35	0.22	Sesquiterpene
α -Cedrene	[0.35]	0.03	Sesquiterpene
β -Caryophyllene	3.41	[3.58]*	Sesquiterpene
β -Copaene	0.22	0.28*	Sesquiterpene
β -Gurjunene	0.05	[0.28]*	Sesquiterpene
α -Maaliene	0.04	[0.74]*	Sesquiterpene
Aromadendrene	0.54	[0.74]*	Sesquiterpene
Selina-5,11-diene	0.06	0.05	Sesquiterpene
<i>cis</i> -Muurolo-3,5-diene	0.11	0.07	Sesquiterpene
Unknown	0.26	0.21	Sesquiterpene
α -Humulene	0.53	0.51	Sesquiterpene
allo-Aromadendrene	0.53	0.60	Sesquiterpene
<i>cis</i> -Muurolo-4(15),5-diene	0.26	[0.21]*	Sesquiterpene
(<i>E</i>)- β -Farnesene	0.92	0.93	Sesquiterpene
<i>trans</i> -Cadina-1(6),4-diene	0.66	[0.62]*	Sesquiterpene
γ -Muurolole	1.83	1.79	Sesquiterpene
α -Amorphene	0.30	0.31	Sesquiterpene
β -Selinene	1.13*	0.74	Sesquiterpene
ar-Curcumene	[1.13]*	[0.41]*	Sesquiterpene
γ -Amorphene	0.21	0.25	Sesquiterpene
α -Selinene	1.41	0.83	Sesquiterpene
α -Muurolole	2.31	2.33	Sesquiterpene
β -Curcumene	0.10	0.09	Sesquiterpene
(3E,6E)- α -Farnesene	3.39*	[0.21]*	Sesquiterpene
γ -Cadinene	[3.39]*	3.36	Sesquiterpene

δ-Cadinene	7.22*	6.40*	Sesquiterpene
Zonarene	[7.22]*	[6.40]*	Sesquiterpene
<i>trans</i> -Cadina-1,4-diene	0.30	[0.41]*	Sesquiterpene
α-Cadinene	0.49	0.51	Sesquiterpene
α-Calacorene	0.11	0.11	Sesquiterpene
Isocaryophyllene epoxide B	0.04	0.02	Sesquiterpenic ether
Palustrol	0.04	0.07	Sesquiterpenic alcohol
(<i>E</i>)-Nerolidol	0.14	0.25*	Sesquiterpenic alcohol
Spathulenol	0.19	0.15	Sesquiterpenic alcohol
Caryophyllene oxide	0.18*	[0.15]*	Sesquiterpenic ether
Caryophyllene oxide isomer	[0.18]*	0.04	Sesquiterpenic ether
Unknown	0.05		Oxygenated sesquiterpene
Unknown	0.12		Unknown
Unknown	0.07		Oxygenated sesquiterpene
10-epi-Cubenol	0.14		Sesquiterpenic alcohol
1-epi-Cubenol	0.22	[0.25]*	Sesquiterpenic alcohol
γ-Eudesmol	0.08	0.05	Sesquiterpenic alcohol
τ-Cadinol	1.03*	0.42	Sesquiterpenic alcohol
τ-Muurolol	[1.03]*	0.46	Sesquiterpenic alcohol
α-Muurolol	0.31	0.18	Sesquiterpenic alcohol
β-Eudesmol	0.13	0.13	Sesquiterpenic alcohol
α-Cadinol	0.57	0.56	Sesquiterpenic alcohol
<i>cis</i> -Calamene-10-ol	0.02	0.03	Sesquiterpenic alcohol
<i>trans</i> -Calamene-10-ol	0.01	0.01	Sesquiterpenic alcohol
α-Bisabolol	0.14	0.12	Sesquiterpenic alcohol
Unknown	0.07		Oxygenated sesquiterpene
Unknown	0.05		Oxygenated sesquiterpene
Unknown	0.04		Oxygenated sesquiterpene
Total identified	97.19%	95.14%	

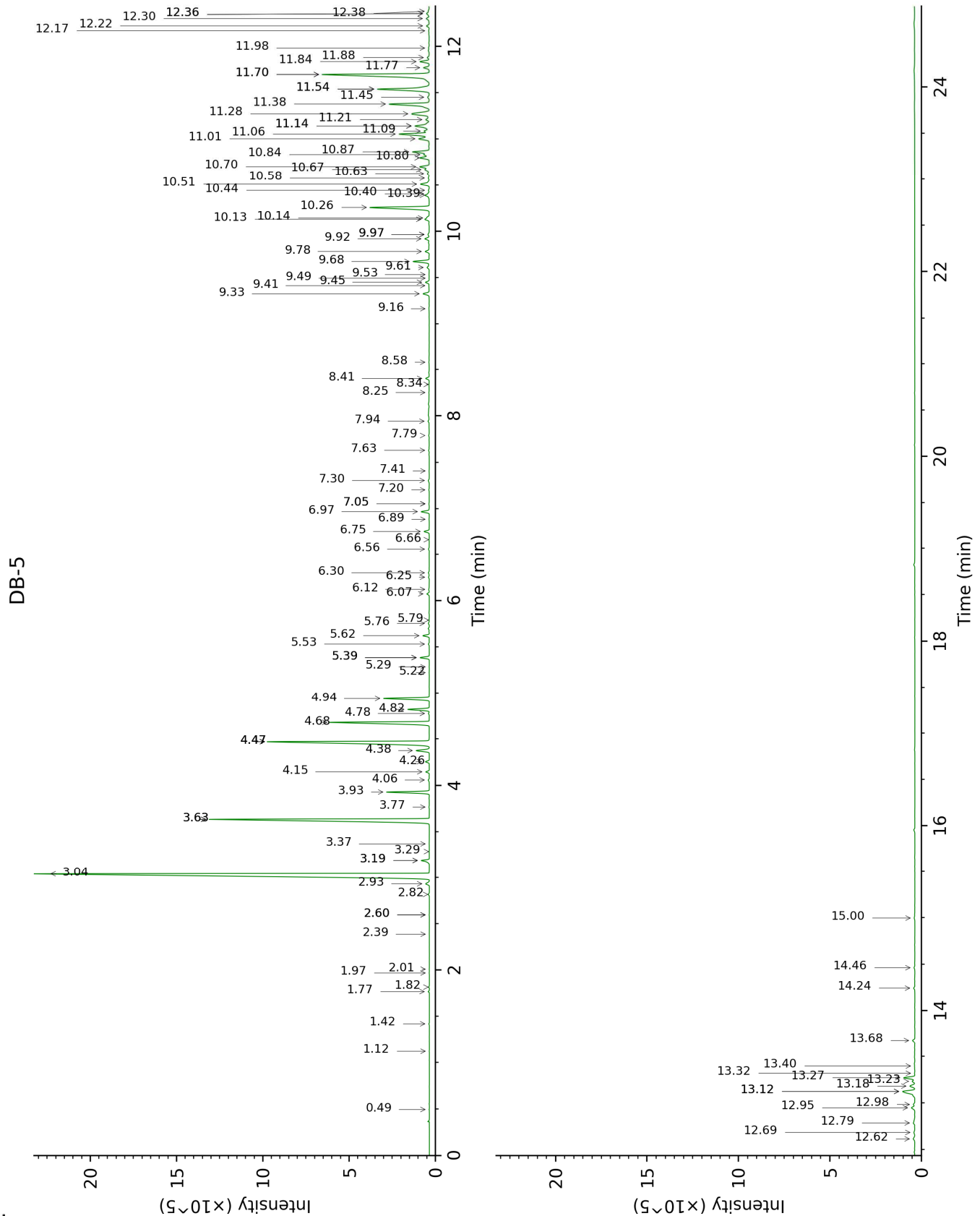
*: Two or more compounds are coeluting on this column

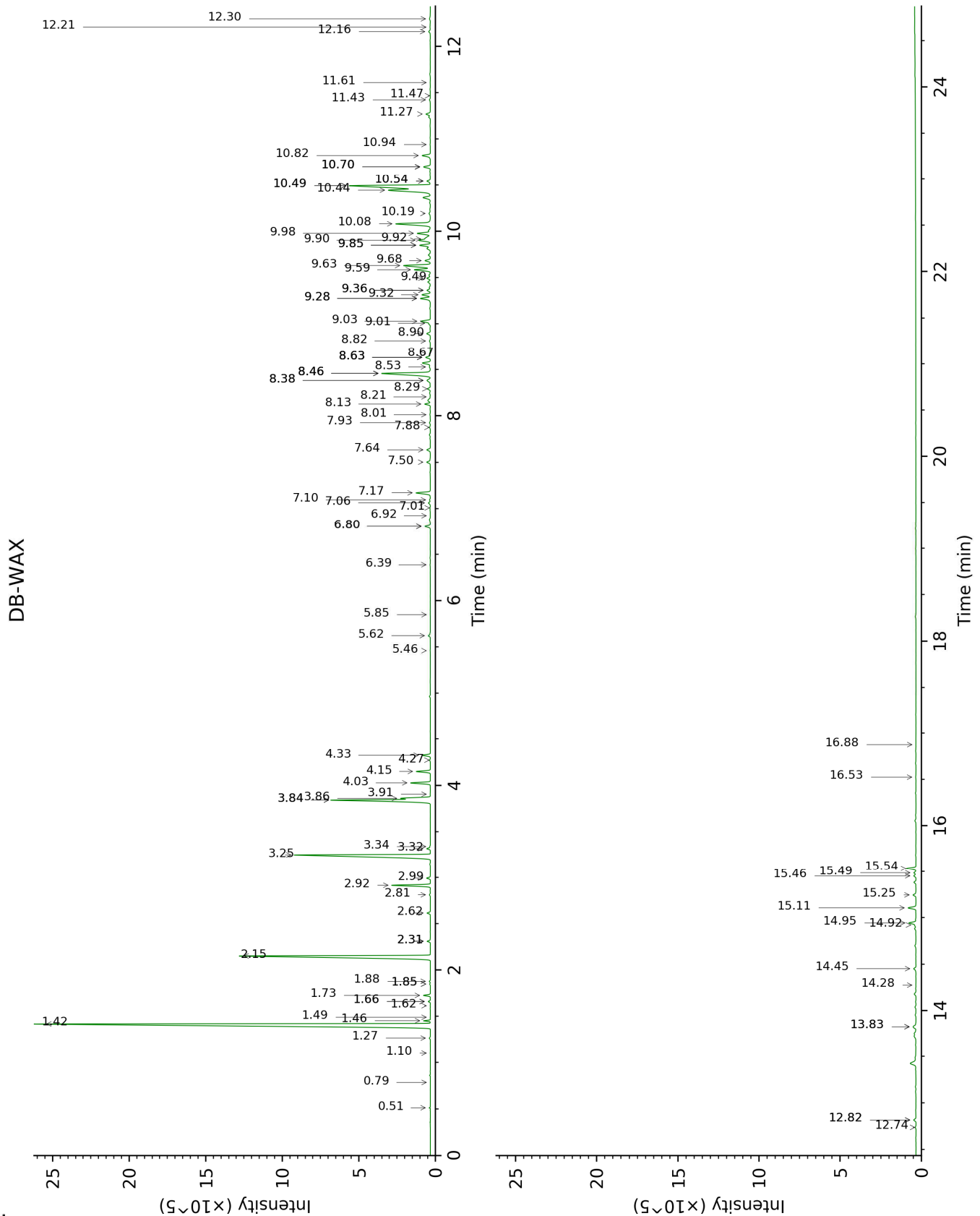
[xx]: Duplicate percentage due to coelutions, not taken account in the identified total

tr: The compound has been detected below 0.005% of total signal.

Note: no correction factor was applied

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FULL ANALYSIS DATA

Identification	Column DB-5			Column DB-WAX		
	R.T	R.I	%	R.T	R.I	%
2-Methyl-3-buten-2-ol	0.50	606	tr	1.62	1020	tr
Toluene	1.12	753	tr	1.49	1007	0.01
Octane	1.42	798	0.02	0.51	773	0.02
5-Methyl-3-hexanone	1.77	829	0.04	1.88	1046	0.04
4-Methyl-3-hexanone	1.82	833	0.02	1.85*	1043	0.03
Ethyl 2-methylbutyrate	1.97	846	0.01	1.66*	1024	0.08
Ethyl isovalerate	2.01	850	0.01	1.85*	1043	[0.03]
Styrene	2.39	882	0.01	3.91	1208	0.01
Bornylene	2.60*	900	0.01	1.10	946	tr
Nonane	2.60*	900	[0.01]	0.78	889	tr
Tricyclene	2.82	915	0.05	1.27	975	0.05
α -Thujene	2.93	923	0.22	1.46	1003	0.22
α -Pinene	3.04	930	28.45	1.42	1000	28.50
Camphene	3.19*	940	0.41	1.73	1031	0.30
α -Fenchene	3.19*	940	[0.41]	1.66*	1024	[0.08]
Thuja-2,4(10)-diene	3.29	947	tr	2.31*	1088	0.15
6-Methyl-2-heptanone	3.37	952	tr	3.84*	1204	5.70
β -Pinene	3.64*	970	12.99	2.15	1073	12.92
Sabinene	3.64*	970	[12.99]	2.31*	1088	[0.15]
Octen-3-ol	3.77	979	0.01	6.80*	1419	0.31
Myrcene	3.93	990	1.78	2.92	1136	1.80
α -Phellandrene	4.06	999	0.05	2.81	1128	0.05
Δ^3 -Carene	4.15	1004	0.15	2.62	1114	0.15
α -Terpinene	4.26	1011	0.17	2.99	1142	0.18
para-Cymene	4.38	1019	0.69	4.15	1224	0.69
β -Phellandrene	4.47*	1025	9.98	3.32	1166	0.16
1,8-Cineole	4.47*	1025	[9.98]	3.34	1168	0.02
Limonene	4.47*	1025	[9.98]	3.25	1161	9.86
(Z)- β -Ocimene	4.68	1038	5.03	3.84*	1204	[5.70]
2-Heptyl acetate	4.78	1044	0.04	4.27	1232	0.04
(E)- β -Ocimene	4.82	1047	0.95	4.03	1216	0.96
γ -Terpinene	4.94	1055	2.02	3.86	1205	1.43
Octanol	5.22	1073	0.01	8.21	1524	0.01
α -Pinene oxide analog	5.29	1077	0.01	5.46	1323	0.01
Terpinolene	5.39*	1083	0.42	4.33	1236	0.40
para-Cymenene	5.39*	1083	[0.42]	6.39	1389	0.02
Ethyl sorbate	5.53	1092	0.04			
Linalool	5.62	1098	0.30	8.13	1518	0.29
endo-Fenchol	5.76	1106	0.05	8.46*	1544	3.58
Octen-3-yl acetate	5.79	1109	0.01	5.85	1350	0.01

allo-Ocimene	6.07	1127	0.12	5.62	1334	0.11
<i>trans</i> -Pinocarveol	6.12	1130	0.04	9.28*	1608	0.62
2-Octyl acetate	6.25	1138	0.04			
Camphene hydrate	6.30	1142	0.06	8.53	1549	0.07
Borneol	6.56	1158	0.04	9.85*	1654	0.63
Ethyl benzoate	6.66	1165	0.01	9.36*	1615	0.21
Terpinen-4-ol	6.75	1170	0.26	8.63*†	1557	0.74
para-Cymen-8-ol	6.89	1179	0.02	11.61	1801	0.01
α-Terpineol	6.97	1185	0.40	9.85*	1654	[0.63]
Methyl salicylate	7.05*	1190	0.02	10.54*	1710	0.21
Myrtenol	7.05*	1190	[0.02]	10.94	1744	0.01
(3 <i>Z</i> ,5 <i>E</i>)-2,6-Dimethylocta-3,5,7-trien-2-ol?	7.20	1200	0.03	11.27	1772	0.27
(3 <i>E</i> ,5 <i>E</i>)-2,6-Dimethylocta-3,5,7-trien-2-ol	7.30	1206	0.06	11.43	1785	0.06
<i>trans</i> -Carveol	7.41	1213	0.01	11.47	1789	0.01
Citronellol	7.63	1228	0.03	10.70*	1724	0.41
2-Nonyl acetate	7.79	1239	0.02			
Unknown [m/z 68, 43 (71), 82 (59), 67 (52), 95 (24), 81 (24)...]	7.94	1250	0.04			
<i>trans</i> -Ascaridole glycol	8.25	1270	0.01	14.28	2045	0.01
Unknown [m/z 43, 43 (84), 72 (81), 97 (90), 95 (60)... 150 (4)]	8.34	1276	0.01	12.82*	1909	0.15
Bornyl acetate	8.41	1280	0.17	8.29	1531	0.17
2-Undecanone	8.58	1292	0.02	8.67	1560	0.06
Bicycloelemene	9.16	1333	0.03	7.10	1441	0.04
α-Cubebene	9.33	1345	0.36	6.80*	1419	[0.31]
Unknown [m/z 95, 147 (61), 96 (39), 93 (37), 94 (37)... 204 (4)]	9.41	1351	0.04			
Citronellyl acetate	9.45	1354	0.20	9.50	1625	0.20
Cyclosativene I	9.49	1357	0.01	6.92	1428	0.01
Cyclosativene II	9.53	1359	0.01	7.01	1434	0.02
α-Ylangene	9.61	1365	0.13	7.06	1438	0.12
α-Copaene	9.68	1369	0.85	7.17	1446	0.85
β-Bourbonene	9.78	1377	0.23	7.50	1471	0.22
β-Elemene	9.92	1387	0.25	8.46*	1544	[3.58]
α-Funebrene	9.97*	1390	0.08	7.93	1503	0.05
7-epi-Sesquithujene	9.97*	1390	[0.08]	7.88	1499	0.05
α-Gurjunene	10.13†	1402	0.35	7.64	1481	0.22

α -Cedrene	10.14†	1403	[0.35]	8.01	1509	0.03
β -Caryophyllene	10.26	1411	3.41	8.46*	1544	[3.58]
β -Copaene	10.39	1421	0.22	8.38*	1538	0.28
β -Gurjunene	10.40	1422	0.05	8.38*	1538	[0.28]
α -Maaliene	10.44	1425	0.04	8.63*†	1557	[0.74]
Aromadendrene	10.51	1430	0.54	8.63*†	1557	[0.74]
Selina-5,11-diene	10.58	1435	0.06	8.82	1571	0.05
<i>cis</i> -Muuro-la-3,5-diene	10.63	1439	0.11	9.01	1586	0.07
Unknown [m/z 91, 161 (92), 105 (85), 119 (63), 133 (53), 79 (49), 204 (46)]	10.67	1442	0.26	8.90	1578	0.21
α -Humulene	10.70	1445	0.53	9.32	1611	0.51
allo-Aromadendrene	10.80	1452	0.53	9.03	1588	0.60
<i>cis</i> -Muuro-la-4(15),5-diene	10.84	1454	0.26	9.36*	1615	[0.21]
(<i>E</i>)- β -Farnesene	10.86	1457	0.92	9.59	1632	0.93
<i>trans</i> -Cadina-1(6),4-diene	11.01	1467	0.66	9.28*	1608	[0.62]
γ -Muuro-lene	11.06	1471	1.83	9.63	1636	1.79
α -Amorphene	11.09	1473	0.30	9.68	1640	0.31
β -Selinene	11.14*	1478	1.13	9.90	1658	0.74
ar-Curcumene	11.14*	1478	[1.13]	10.70*	1724	[0.41]
γ -Amorphene	11.21	1483	0.21	9.92	1659	0.25
α -Selinene	11.28	1487	1.41	9.98	1664	0.83
α -Muuro-lene	11.38	1495	2.31	10.08	1672	2.33
β -Curcumene	11.45	1501	0.10	10.19	1682	0.09
(3 <i>E</i> ,6 <i>E</i>)- α -Farnesene	11.54*	1508	3.39	10.54*	1710	[0.21]
γ -Cadinene	11.54*	1508	[3.39]	10.44	1702	3.36
δ -Cadinene	11.70*	1520	7.22	10.49*	1706	6.40
Zonarene	11.70*	1520	[7.22]	10.49*	1706	[6.40]
<i>trans</i> -Cadina-1,4-diene	11.77	1526	0.30	10.70*	1724	[0.41]
α -Cadinene	11.84	1531	0.49	10.82	1734	0.51
α -Calacorene	11.88	1534	0.11	12.16	1850	0.11
Isocaryophyllene epoxide B	11.98	1543	0.04	12.21	1854	0.02
Palustrol	12.17	1557	0.04	12.30	1862	0.07
(<i>E</i>)-Nerolidol	12.22	1561	0.14	13.83*	2002	0.25
Spathulenol	12.30	1568	0.19	14.45	2062	0.15
Caryophyllene oxide	12.36*	1572	0.18	12.82*	1909	[0.15]
Caryophyllene oxide isomer	12.36*	1572	[0.18]	12.74	1901	0.04
Unknown [m/z 109, 43 (95), 81 (81), 93 (76), 69	12.38	1574	0.05			

(75), 95 (74), 107 (71)... 204 (22), 220 (6)]						
Unknown [m/z 109, 43 (89), 122 (88), 69 (78), 107 (78), 81 (78)...]	12.62	1592	0.12			
Unknown [m/z 149, 43 (95), 93 (84), 177 (66), 109 (62), 67 (60)...220 (11)]	12.68	1598	0.07			
10-epi-Cubenol	12.79	1606	0.14			
1-epi-Cubenol	12.95	1620	0.22	13.83*	2002	[0.25]
γ-Eudesmol	12.98	1622	0.08	14.92	2108	0.05
τ-Cadinol	13.12*	1634	1.03	14.95	2110	0.42
τ-Muurolol	13.12*	1634	[1.03]	15.11	2126	0.46
α-Muurolol	13.18	1639	0.31	15.25	2140	0.18
β-Eudesmol	13.23	1643	0.13	15.46	2161	0.13
α-Cadinol	13.27	1646	0.57	15.54	2170	0.56
cis-Calamenen-10-ol	13.32	1650	0.02	16.53	2271	0.03
trans-Calamenen-10-ol	13.40	1657	0.01	16.88	2308	0.01
α-Bisabolol	13.68	1680	0.14	15.49	2164	0.12
Unknown [m/z 91, 175 (93), 105 (76), 79 (73), 133 (69), 107 (60)...218 (33)]	14.24	1728	0.07			
Unknown [m/z 91, 177 (75), 79 (68), 105 (65), 93 (62), 159 (60)...220 (16)]	14.46	1747	0.05			
Unknown [m/z 43, 41 (72), 95 (69), 81 (66), 67 (55), 55 (52), 79 (52), 69 (50)... 238 (1)]	15.00	1794	0.04			
Total identified		97.19%			95.14%	
Total reported		97.95%			95.36%	

*: Two or more compounds are coeluting on this column

[xx]: Duplicate percentage due to coelutions, not taken account in the identified total

†: Peaks apexes were resolved, but peaks overlapped and were summed for analysis

tr: The compound has been detected below 0.005% of total signal.

Note: no correction factor was applied

R.T.: Retention time (minutes)

R.I.: Retention index