

Date : February 05, 2019

CERTIFICATE OF ANALYSIS – GC PROFILING

SAMPLE IDENTIFICATION

Internal code : 19B05-PTH03-1-SCC

Customer identification : Lime Cold - Mexico - LA010689R

Type : Essential oil

Source : *Citrus aurantifolia*

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 : February 05, 2019

Checked and approved by :

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

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PHYSICOCHEMICAL DATA

Physical aspect: Greenish yellow liquid

Refractive index: 1.4833 ± 0.0003 (20 °C)

ISO 3809:2004 - OIL OF LIME, COLD-PRESSED, MEXICAN TYPE - TYPE A

Compound	Min. %	Max. %	Observed %	Complies?
β-Bisabolene	1.0	1.5	2.5	No
(3E,6E)-α-Farnesene	0.75	1.75	1.3	Yes
trans-α-Bergamotene	1.0	1.9	1.5	Yes
β-Caryophyllene	0.5	1.5	1.2	Yes
Geranyl acetate	0.2	0.4	0.2	Yes
Neryl acetate	0.10	0.35	0.34	Yes
Geranial	2.0	3.0	2.6	Yes
Neral	1.2	2.0	1.6	Yes
Decanal	0.05	0.30	0.18	Yes
α-Terpineol	0.2	0.6	0.3	Yes
Terpinen-4-ol	0.2	0.6	0.4	Yes
γ-Terpinene	8.0	11.0	8.8	Yes
Limonene	42.0	50.0	45.6	Yes
para-Cymene		0.5	0.4	Yes
Myrcene	1.0	2.0	1.2	Yes
β-Pinene	18.0	24.0	17.7	No
Sabinene	1.8	4.0	2.5	Yes
α-Pinene	2.0	3.0	2.1	Yes
Refractive index	1.4820	1.4860	1.4833	Yes

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
Heptanal	0.01*	0.01	Aliphatic aldehyde
Nonane	[0.01]*	0.01	Alkane
Tricyclene	0.01	0.01	Monoterpene
α -Thujene	0.37	0.39	Monoterpene
α -Pinene	2.06	2.09	Monoterpene
α -Fenchene	0.10*	0.01	Monoterpene
Camphene	[0.10]*	0.09	Monoterpene
Thuja-2,4(10)-diene	0.01	2.54*	Monoterpene
β -Pinene	19.89*	17.70	Monoterpene
Sabinene	[19.89]*	[2.54]*	Monoterpene
3-Methyl-3-cyclohexenone	0.01	tr	Aliphatic ketone
6-Methyl-5-hepten-2-one	0.05	0.04	Aliphatic ketone
Myrcene	1.19	1.21	Monoterpene
Pseudolimonene	0.08*	0.01	Monoterpene
Octanal	[0.08]*	0.03	Aliphatic aldehyde
α -Phellandrene	[0.08]*	0.04	Monoterpene
Δ^3 -Carene	0.01	0.01	Monoterpene
α -Terpinene	0.19	0.19	Monoterpene
para-Cymene	45.81	0.36	Monoterpene
Limonene	[45.81]*	45.55	Monoterpene
1,8-Cineole	[45.81]*	0.49	Monoterpenic ether
(Z?)-Citroxide	[45.81]*	tr	Monoterpenic ether
(Z)- β -Ocimene	[45.81]	tr	Monoterpene
(E?)-Citroxide	tr	9.07*	Monoterpenic ether
(E)- β -Ocimene	0.35	0.35	Monoterpene
γ -Terpinene	8.78	[9.07]*	Monoterpene
cis-Sabinene hydrate	0.05	0.05*	Monoterpenic alcohol
Terpinolene	0.43	0.44	Monoterpene
trans-Sabinene hydrate	0.05	0.05	Monoterpenic alcohol
Linalool	0.16	0.17	Monoterpenic alcohol
Nonanal	0.04	0.02	Aliphatic aldehyde
endo-Fenchol	0.01	tr	Monoterpenic alcohol
trans-para-Mentha-2,8-dien-1-ol	0.02	0.01	Monoterpenic alcohol
cis-Limonene oxide	0.01	0.01	Monoterpenic ether
1-Terpineol	0.02	0.02	Monoterpenic alcohol
trans-Limonene oxide	0.01	tr	Monoterpenic ether
Epoxyterpinolene	0.01	[0.05]*	Monoterpenic ether
cis- β -Terpineol	tr	0.01	Monoterpenic alcohol
Citronellal	0.03*	0.44*	Monoterpenic aldehyde
Isoborneol	[0.03]*	0.01	Monoterpenic alcohol
Pinocarvone	0.01	0.01	Monoterpenic ketone
Borneol	0.02	0.40*	Monoterpenic alcohol
trans- β -Terpineol	0.02*	0.12*	Monoterpenic alcohol
Isoneral	[0.02]*	0.01	Monoterpenic aldehyde
α -Phellandren-8-ol	0.02	0.03	Monoterpenic alcohol
Terpinen-4-ol	0.37	0.37	Monoterpenic alcohol
4-Methylacetophenone	tr	0.01	Simple phenolic

para-Cymen-8-ol	0.04*	0.01	Monoterpenic alcohol
Isogeranial	[0.04]*	0.03	Monoterpenic aldehyde
α -Terpineol	0.34	[0.40]*	Monoterpenic alcohol
γ -Terpineol	0.01	0.32*	Monoterpenic alcohol
Decanal	0.18	0.19*	Aliphatic aldehyde
<i>trans</i> -Carveol	0.01	tr	Monoterpenic alcohol
2,3-Epoxyneral?	0.02		Monoterpenic aldehyde
Nerol	0.08	0.08	Monoterpenic alcohol
2,3-Epoxygeranial?	0.08		Monoterpenic aldehyde
Neral	1.58	1.66*	Monoterpenic aldehyde
Geraniol	0.09	0.10	Monoterpenic alcohol
Unknown	tr	0.01	Unknown
<i>trans</i> -Ascaridole glycol	2.56*	0.01	Monoterpenic alcohol
Geranial	[2.56]*	2.62	Monoterpenic aldehyde
Unknown	0.02	tr	Unknown
Unknown	0.03	0.02	Oxygenated monoterpene
<i>cis</i> -Ascaridole glycol?	0.01	0.13	Monoterpenic alcohol
Undecanal	0.03	0.03	Aliphatic aldehyde
Unknown	0.01	0.02	Monoterpenic alcohol
δ -Elemene	0.41	[0.44]*	Sesquiterpene
Citronellyl acetate	0.02	[1.66]*	Monoterpenic ester
Neryl acetate	0.34	0.42	Monoterpenic ester
α -Copaene	tr	tr	Sesquiterpene
7-Cubebene	tr	tr	Sesquiterpene
7-Cubebene epimer?	0.02	[0.19]*	Aliphatic alcohol
β -Bourbonene	0.01	0.02	Sesquiterpene
Geranyl acetate	0.24	1.50*	Monoterpenic ester
β -Elemene	0.24	[2.97]*	Sesquiterpene
Dodecanal	0.12	0.12	Aliphatic aldehyde
β -Caryophyllene	1.29*	2.97	Sesquiterpene
<i>cis</i> - α -Bergamotene	[1.29]*	0.13	Sesquiterpene
γ -Elemene	0.05	0.07	Sesquiterpene
<i>trans</i> - α -Bergamotene	1.52	[2.97]*	Sesquiterpene
α -Humulene	0.14	0.15	Sesquiterpene
β -Santalene	0.21*	0.01	Sesquiterpene
(<i>E</i>)- β -Farnesene	[0.21]*	0.17	Sesquiterpene
Selina-4,11-diene	0.02	[1.66]*	Sesquiterpene
Germacrene D	0.30	[0.32]*	Sesquiterpene
Unknown	0.04*	[0.32]*	Sesquiterpene
γ -Curcumene	[0.04]*	0.03	Sesquiterpene
β -Selinene	0.12*	0.03	Sesquiterpene
<i>trans</i> - β -Bergamotene	[0.12]*	[0.12]*	Sesquiterpene
α -Selinene	0.07	0.06	Sesquiterpene
(<i>Z</i>)- α -Bisabolene	0.18	0.19*	Sesquiterpene
γ -Cadinene	3.38*	[0.19]*	Sesquiterpene
(3 <i>E</i> ,6 <i>E</i>)- α -Farnesene	[3.38]*	[1.50]*	Sesquiterpene
β -Bisabolene	[3.38]*	2.46	Sesquiterpene
(<i>E</i>)- γ -Bisabolene	0.02	0.02	Sesquiterpene
Selina-4(15),7(11)-diene	0.01	0.01	Sesquiterpene
Unknown	0.01	[1.50]*	Sesquiterpene
(<i>E</i>)- α -Bisabolene	0.07	0.06	Sesquiterpene
Germacrene B	0.57	0.59	Sesquiterpene

Caryophyllenyl alcohol	0.02	0.02	Sesquiterpenic alcohol
Caryophyllene oxide	0.01	0.01	Sesquiterpenic ether
Tetradecanal	0.05	0.05	Aliphatic aldehyde
Guaia-6,10(14)-dien-4 β -ol	0.07	0.06	Sesquiterpenic alcohol
Unknown	0.03	0.02	Sesquiterpenic alcohol
Unknown	0.08	0.07	Oxygenated sesquiterpene
α -Bisabolol	0.14	0.14*	Sesquiterpenic alcohol
Herniarin	0.08	0.11	Coumarin
(2E,6Z)-Farnesal	0.02		Sesquiterpenic aldehyde
(2E,6E)-Farnesal	0.03	0.05	Sesquiterpenic aldehyde
Myristic acid	0.20	0.24	Aliphatic acid
Hexadecanal	tr	tr	Aliphatic aldehyde
meta-Camphorene	0.01	[0.14]*	Diterpene
Citropten	0.33		Furanocoumarin
Palmitic acid	0.16	0.19	Aliphatic acid
Bergapten	0.11		Furanocoumarin
Linoleic acid	0.11		Aliphatic acid
Oleic acid	0.08	0.06	Aliphatic acid
cis-Vaccenic acid?	0.04	0.05	Aliphatic acid
Stearic acid	0.11	0.13	Aliphatic acid
Isopimpinellin	0.28		Furanocoumarin
Oxypeucedanin	0.01		Furanocoumarin
Total identified	96.42%	97.72%	

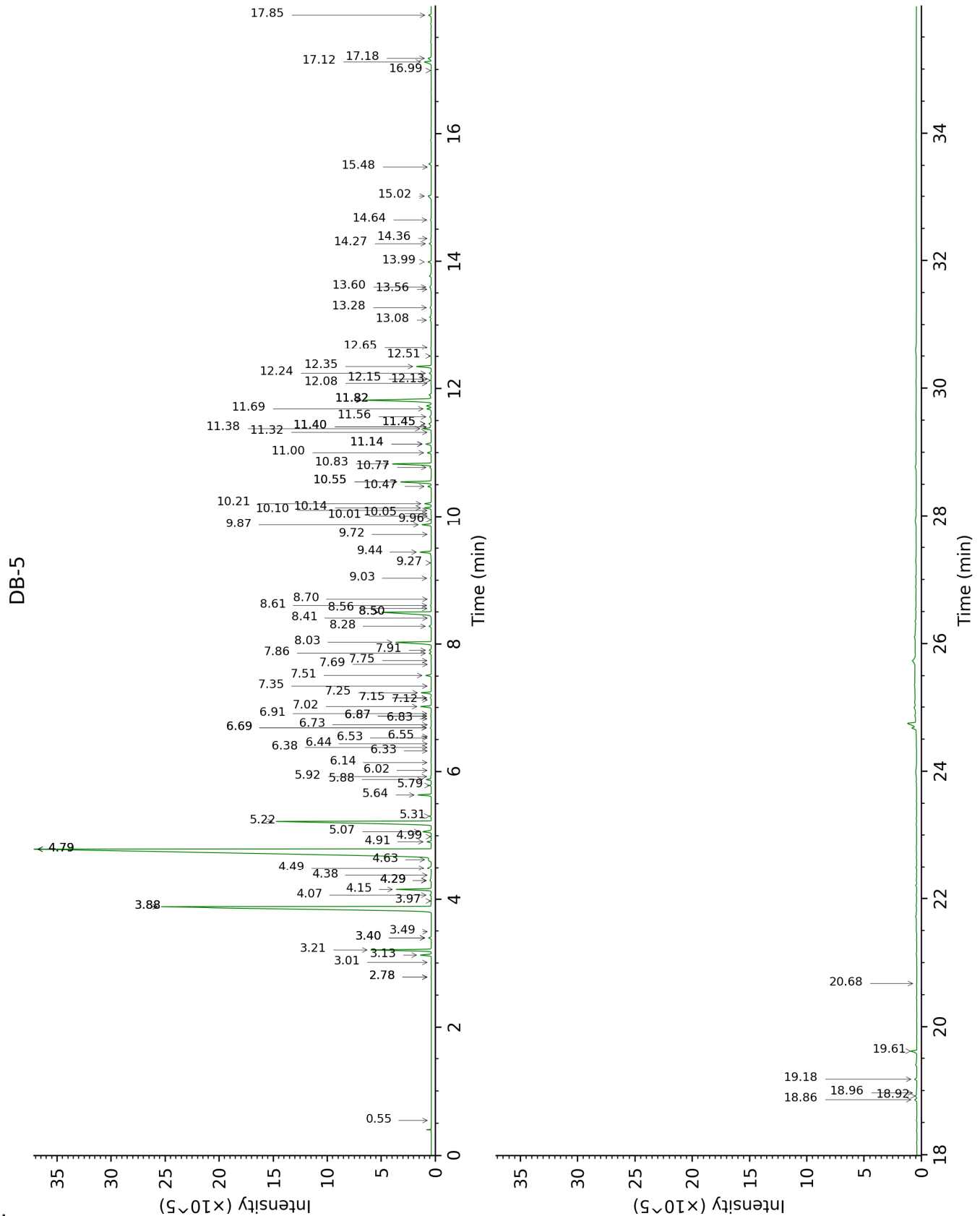
*: Two or more compounds are coeluting on this column

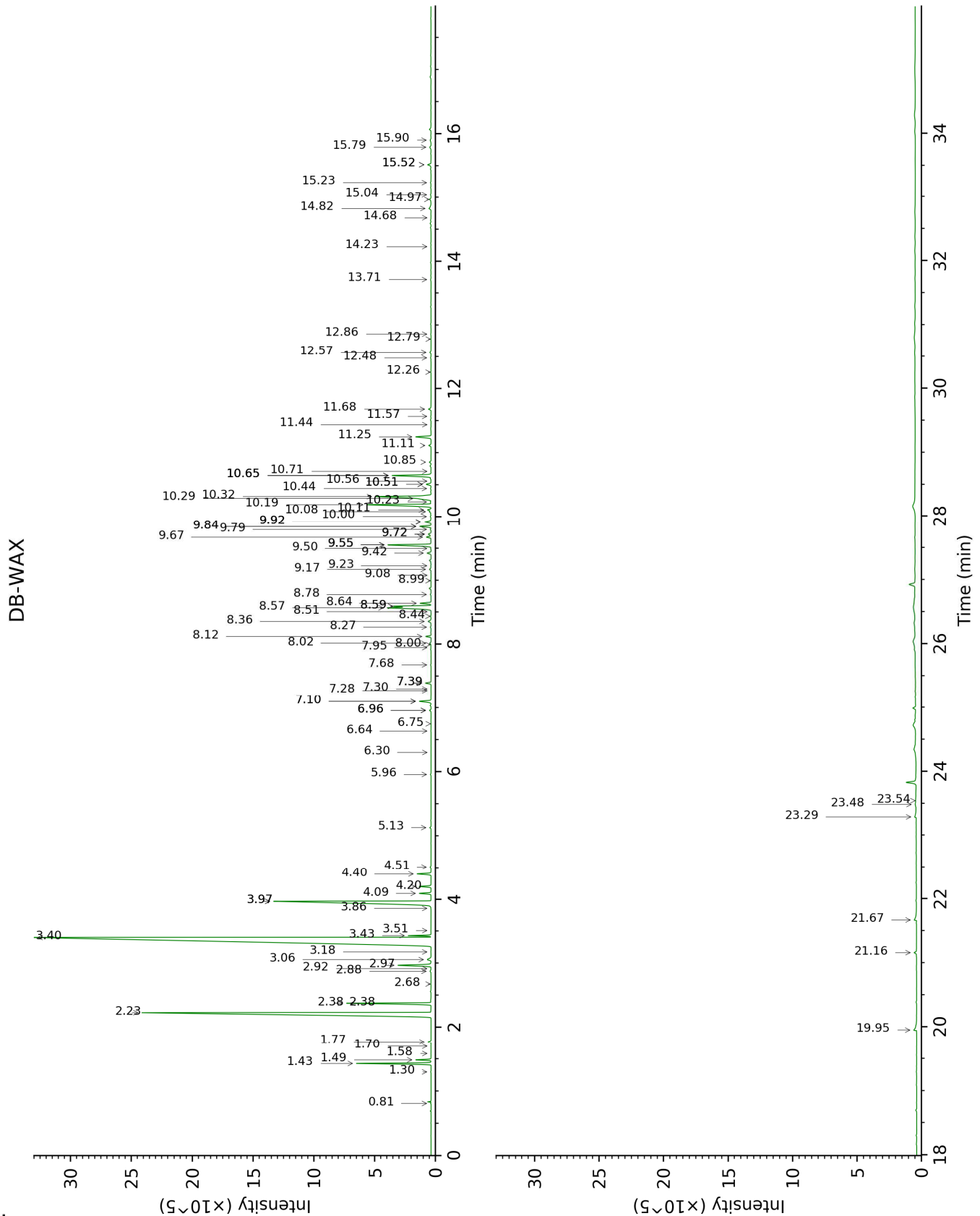
[xx]: Duplicate percentage due to coelutions, not taken account in the identified total

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	0.54	605	tr	1.58	1012	tr
Heptanal	2.78*	901	0.01	3.18	1152	0.01
Nonane	2.78*	901	[0.01]	0.81	900	0.01
Tricyclene	3.01	916	0.01	1.30	976	0.01
α -Thujene	3.13	924	0.37	1.48	1003	0.39
α -Pinene	3.21	929	2.06	1.43	995	2.09
α -Fenchene	3.40*	941	0.10	1.70	1023	0.01
Camphene	3.40*	941	[0.10]	1.77	1029	0.09
Thuja-2,4(10)-diene	3.49	947	0.01	2.38*	1087	2.54
β -Pinene	3.88*	973	19.89	2.23	1072	17.70
Sabinene	3.88*	973	[19.89]	2.38*	1087	[2.54]
3-Methyl-3-cyclohexenone	3.97	979	0.01	6.30	1375	tr
6-Methyl-5-hepten-2-one	4.06	985	0.05	5.13	1305	0.04
Myrcene	4.15	991	1.19	2.97	1135	1.21
Pseudolimonene	4.29*†	1000	0.08	2.92	1131	0.01
Octanal	4.29*†	1000	[0.08]	4.51	1256	0.03
α -Phellandrene	4.29*†	1000	[0.08]	2.88	1128	0.04
Δ^3 -Carene	4.38	1005	0.01	2.68	1112	0.01
α -Terpinene	4.49	1012	0.19	3.06	1142	0.19
para-Cymene	4.63†	1021	45.81	4.20	1232	0.36
Limonene	4.79*†	1031	[45.81]	3.40	1170	45.55
1,8-Cineole	4.79*†	1031	[45.81]	3.43	1172	0.49
(Z)-Citroxide	4.79*†	1031	[45.81]	3.51	1178	tr
(Z)- β -Ocimene	4.91†	1038	[45.81]	3.86	1206	tr
(E)-Citroxide	4.99	1043	tr	3.97*	1214	9.07
(E)- β -Ocimene	5.06	1048	0.35	4.09	1224	0.35
γ -Terpinene	5.22	1058	8.78	3.97*	1214	[9.07]
cis-Sabinene hydrate	5.31	1063	0.05	6.96*	1424	0.05
Terpinolene	5.64	1084	0.43	4.40	1247	0.44
trans-Sabinene hydrate	5.79	1093	0.05	8.02	1505	0.05
Linalool	5.88	1099	0.16	8.12	1513	0.17
Nonanal	5.92	1102	0.04	5.96	1350	0.02
endo-Fenchol	6.02	1108	0.01	8.51	1544	tr
trans-para-Mentha-2,8-dien-1-ol	6.14	1116	0.02	8.99	1582	0.01
cis-Limonene oxide	6.32	1127	0.01	6.64	1400	0.01
1-Terpineol	6.38	1131	0.02	8.44	1538	0.02
trans-Limonene oxide	6.44	1134	0.01	6.75	1408	tr
Epoxyterpinolene	6.53	1140	0.01	6.96*	1424	[0.05]
cis- β -Terpineol	6.55	1142	tr	9.08	1589	0.01
Citronellal	6.69*	1150	0.03	7.10*	1435	0.44
Isoborneol	6.69*	1150	[0.03]	9.50	1623	0.01
Pinocarvone	6.73	1154	0.01	8.00	1503	0.01

Borneol	6.83	1160	0.02	9.84*	1651	0.40
<i>trans</i> -β-Terpineol	6.87*	1162	0.02	9.72*	1641	0.12
Isoneal	6.87*	1162	[0.02]	7.95	1500	0.01
α-Phellandren-8-ol	6.91	1165	0.02	10.23	1683	0.03
Terpinen-4-ol	7.02	1172	0.37	8.64	1554	0.37
4-Methylacetophenone	7.12	1178	tr	10.56	1710	0.01
para-Cymen-8-ol	7.15*	1180	0.04	11.57	1797	0.01
Isogeranial	7.15*	1180	[0.04]	8.27	1525	0.03
α-Terpineol	7.24	1186	0.34	9.84*	1651	[0.40]
γ-Terpineol	7.35	1193	0.01	9.92*	1657	0.32
Decanal	7.51	1204	0.18	7.39*	1458	0.19
<i>trans</i> -Carveol	7.69	1216	0.01	11.44	1786	tr
2,3-Epoxyneral?	7.75	1220	0.02			
Nerol	7.86	1227	0.08	11.11	1758	0.08
2,3-Epoxygeranial?	7.91	1230	0.08			
Neral	8.03	1239	1.58	9.55*	1627	1.66
Geraniol	8.28	1256	0.09	11.68	1807	0.10
Unknown [m/z 43, 128 (61), 79 (60), 127 (52), 58 (50)...]	8.41	1264	tr	12.26	1859	0.01
<i>trans</i> -Ascaridole glycol	8.50*	1270	2.56	14.23	2042	0.01
Geranial	8.50*	1270	[2.56]	10.19	1680	2.62
Unknown [m/z 43, 79 (78), 128 (46), 58 (42), 127 (42)...]	8.56	1275	0.02	12.79	1906	tr
Unknown [m/z 95, 67 (45), 41 (42), 110 (42), 43 (41), 59 (36)]	8.61	1278	0.03	12.48	1879	0.02
<i>cis</i> -Ascaridole glycol?	8.70	1284	0.01	14.82	2100	0.13
Undecanal	9.03	1303	0.03	8.78	1565	0.03
Unknown [m/z 97, 112 (92), 83 (62), 43 (44), 41 (25)... 170? (4)]	9.27	1320	0.01	15.04	2121	0.02
δ-Elemene	9.44	1332	0.41	7.10*	1435	[0.44]
Citronellyl acetate	9.72	1351	0.02	9.55*	1627	[1.66]
Neryl acetate	9.87	1362	0.34	10.29	1688	0.42
α-Copaene	9.96	1368	tr	7.30	1450	tr
7-Cubebene	10.01	1372	tr	7.28	1448	tr
7-Cubebene epimer?	10.05	1375	0.02	7.39*	1458	[0.19]
β-Bourbonene	10.10	1378	0.01	7.68	1479	0.02
Geranyl acetate	10.14	1381	0.24	10.65*	1718	1.50
β-Elemene	10.21	1386	0.24	8.59*†	1550	[2.97]
Dodecanal	10.48	1405	0.12	10.11	1673	0.12
β-Caryophyllene	10.55*	1410	1.29	8.57†	1549	2.97
<i>cis</i> -α-Bergamotene	10.55*	1410	[1.29]	8.36	1532	0.13
γ-Elemene	10.77	1427	0.05	9.17	1596	0.07
<i>trans</i> -α-Bergamotene	10.83	1431	1.52	8.59*†	1550	[2.97]
α-Humulene	11.00	1444	0.14	9.42	1617	0.15
β-Santalene	11.14*	1454	0.21	9.23	1600	0.01

(E)-β-Farnesene	11.14*	1454	[0.21]	9.67	1637	0.17
Selina-4,11-diene	11.32	1468	0.02	9.55*	1627	[1.66]
Germacrene D	11.38	1472	0.30	9.92*	1657	[0.32]
Unknown [m/z 91, 93 (92), 105 (71), 77 (69), 79 (68), 133 (63)... 204 (32)]	11.40*	1474	0.04	9.92*	1657	[0.32]
γ-Curcumene	11.40*	1474	[0.04]	9.80	1647	0.03
β-Selinene	11.45*	1478	0.12	10.00	1664	0.03
trans-β-Bergamotene	11.45*	1478	[0.12]	9.72*	1641	[0.12]
α-Selinene	11.56	1486	0.07	10.08	1671	0.06
(Z)-α-Bisabolene	11.69	1495	0.18	10.51*	1706	0.19
γ-Cadinene	11.82*	1506	3.38	10.51*	1706	[0.19]
(3E,6E)-α-Farnesene	11.82*	1506	[3.38]	10.65*	1718	[1.50]
β-Bisabolene	11.82*	1506	[3.38]	10.32	1690	2.46
(E)-γ-Bisabolene	12.08	1526	0.02	10.44	1701	0.02
Selina-4(15),7(11)-diene	12.13	1530	0.01	10.71	1724	0.01
Unknown [m/z 189, 204 (92), 161 (65), 133 (51), 105 (51), 91 (51), 119 (45)]	12.15	1531	0.01	10.65*	1718	[1.50]
(E)-α-Bisabolene	12.24	1538	0.07	10.85	1736	0.06
Germacrene B	12.35	1547	0.57	11.25	1770	0.59
Caryophyllenyl alcohol	12.51	1560	0.02	13.71	1993	0.02
Caryophyllene oxide	12.65	1571	0.01	12.86	1913	0.01
Tetradecanal	13.08	1604	0.05	12.57	1886	0.05
Guaia-6,10(14)-dien-4β-ol	13.28	1620	0.07	15.79	2196	0.06
Unknown cadinol analog II [m/z 95, 121 (73), 43 (57), 79 (43), 161 (43), 109 (40)... 204 (35), 222 (2)]	13.56	1644	0.03	15.23	2140	0.02
Unknown [m/z 94, 43 (89), 41 (67), 122 (46), 69 (41)...222]	13.60	1647	0.08	14.97	2114	0.07
α-Bisabolol	13.99	1679	0.14	15.52*	2169	0.14
Herniarin	14.27	1703	0.08	21.16	2802	0.11
(2E,6Z)-Farnesal	14.36	1710	0.02			
(2E,6E)-Farnesal	14.64	1735	0.03	15.90	2208	0.05
Myristic acid	15.02	1767	0.20	19.95	2655	0.24
Hexadecanal	15.48	1808	tr	14.68	2086	tr
meta-Camphorene	16.99	1946	0.01	15.52*	2169	[0.14]
Citropten	17.12	1959	0.33			
Palmitic acid	17.18	1964	0.16	21.67	2866	0.19
Bergapten	17.85	2030	0.11			
Linoleic acid	18.86	2131	0.11			
Oleic acid	18.92	2136	0.08	23.48	3103	0.06
cis-Vaccenic acid?	18.96	2142	0.04	23.54	3111	0.05
Stearic acid	19.18	2163	0.11	23.29	3077	0.13

Isopimpinellin	19.61	2209	0.28	
Oxypeucedanin	20.68	2324	0.01	
Total identified		96.42%		97.72%
Total reported		96.60%		97.87%

*: 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