

Date : May 22, 2019

CERTIFICATE OF ANALYSIS – GC PROFILING

SAMPLE IDENTIFICATION

Internal code : 19E21-PTH06-1-SCC

Customer identification : Key Lime - K3010093R

Type : Essential oil

Source : *Citrus aurantifolia*

Customer : Plant Therapy

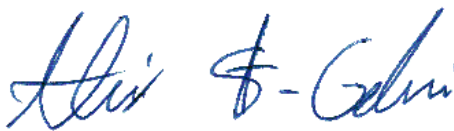
ANALYSIS

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 : Lindsay Girard, B. Sc.

Analysis date : May 22, 2019

Checked and approved by :



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

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PHYSICOCHEMICAL DATA

Physical aspect: Dark yellowish green liquid

Refractive index: 1.4835 ± 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	1.9	No
(3E,6E)-α-Farnesene	0.75	1.75	0.91	Yes
trans-α-Bergamotene	1.0	1.9	1.3	Yes
β-Caryophyllene	0.5	1.5	1.0	Yes
Geranyl acetate	0.2	0.4	0.2	Yes
Neryl acetate	0.10	0.35	0.53	No
Geranial	2.0	3.0	2.6	Yes
Neral	1.2	2.0	1.7	Yes
Decanal	0.05	0.30	0.09	Yes
α-Terpineol	0.2	0.6	0.2	Yes
Terpinen-4-ol	0.2	0.6	0.1	No
γ-Terpinene	8.0	11.0	10.1	Yes
Limonene	42.0	50.0	47.7	Yes
para-Cymene		0.5	0.4	Yes
Myrcene	1.0	2.0	1.3	Yes
β-Pinene	18.0	24.0	16.8	No
Sabinene	1.8	4.0	2.4	Yes
α-Pinene	2.0	3.0	2.0	Yes
Refractive index	1.4820	1.4860	1.4835	Yes

CONCLUSION

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

The oil marginally does not comply with the ISO standard for type A cold-pressed lime oil.

ANALYSIS SUMMARY

Identification	DB-5 (%)	DB-WAX (%)	Classe
Nonane	0.01	0.01	Alkane
Tricyclene	0.01	0.01	Monoterpene
α -Thujene	0.41	0.39	Monoterpene
α -Pinene	2.05	2.03	Monoterpene
Camphene	0.10*	0.09	Monoterpene
α -Fenchene	[0.10]*	0.01	Monoterpene
Thuja-2,4(10)-diene	0.02	2.37*	Monoterpene
Sabinene	19.19*	[2.37]*	Monoterpene
β -Pinene	[19.19]*	16.83	Monoterpene
6-Methyl-5-hepten-2-one	0.03	0.03	Aliphatic ketone
Myrcene	1.25	1.26	Monoterpene
α -Phellandrene	0.06*	0.04	Monoterpene
Pseudolimonene	[0.06]*	0.01	Monoterpene
Octanal	[0.06]*	0.02	Aliphatic aldehyde
Δ^3 -Carene	0.01	0.01	Monoterpene
α -Terpinene	0.18	0.18	Monoterpene
para-Cymene	0.39	0.41	Monoterpene
Limonene	47.63*	47.66	Monoterpene
1,8-Cineole	[47.63]*	0.48	Monoterpenic ether
(Z)- β -Ocimene	0.11	10.41*	Monoterpene
(E)- β -Ocimene	0.26	0.27	Monoterpene
γ -Terpinene	10.15	[10.41]*	Monoterpene
cis-Sabinene hydrate	0.04	0.05	Monoterpenic alcohol
Terpinolene	0.44	0.45	Monoterpene
trans-Sabinene hydrate	0.04	0.04	Monoterpenic alcohol
Linalool	0.12	0.12	Monoterpenic alcohol
Nonanal	0.03	0.02	Aliphatic aldehyde
trans-para-Mentha-2,8-dien-1-ol	0.02	0.01	Monoterpenic alcohol
1-Terpineol	0.01	0.02	Monoterpenic alcohol
Epoxyterpinolene	0.01	0.01	Monoterpenic ether
Citronellal	0.04	0.04	Monoterpenic aldehyde
Borneol	0.01	0.44*	Monoterpenic alcohol
trans- β -Terpineol	0.02	0.02	Monoterpenic alcohol
Isoneral	0.01	0.01	Monoterpenic aldehyde
Terpinen-4-ol	0.10	0.10	Monoterpenic alcohol
Isogeranial	0.03	0.13*	Monoterpenic aldehyde
α -Terpineol	0.18	[0.44]*	Monoterpenic alcohol
γ -Terpineol	0.01	0.01	Monoterpenic alcohol
Decanal	0.09	0.09	Aliphatic aldehyde
2,3-Epoxyneral?	0.02		Monoterpenic aldehyde
Nerol	0.08	0.09	Monoterpenic alcohol
2,3-Epoxygeranial?	0.05		Monoterpenic aldehyde
Neral	1.68	1.79*	Monoterpenic aldehyde
Geraniol	0.04	0.05	Monoterpenic alcohol
trans-Ascaridole glycol	0.02	0.02	Monoterpenic alcohol
Geranial	2.57	2.13	Monoterpenic aldehyde
Unknown	0.02	0.03	Oxygenated monoterpene
Undecanal	0.02	0.02	Aliphatic aldehyde

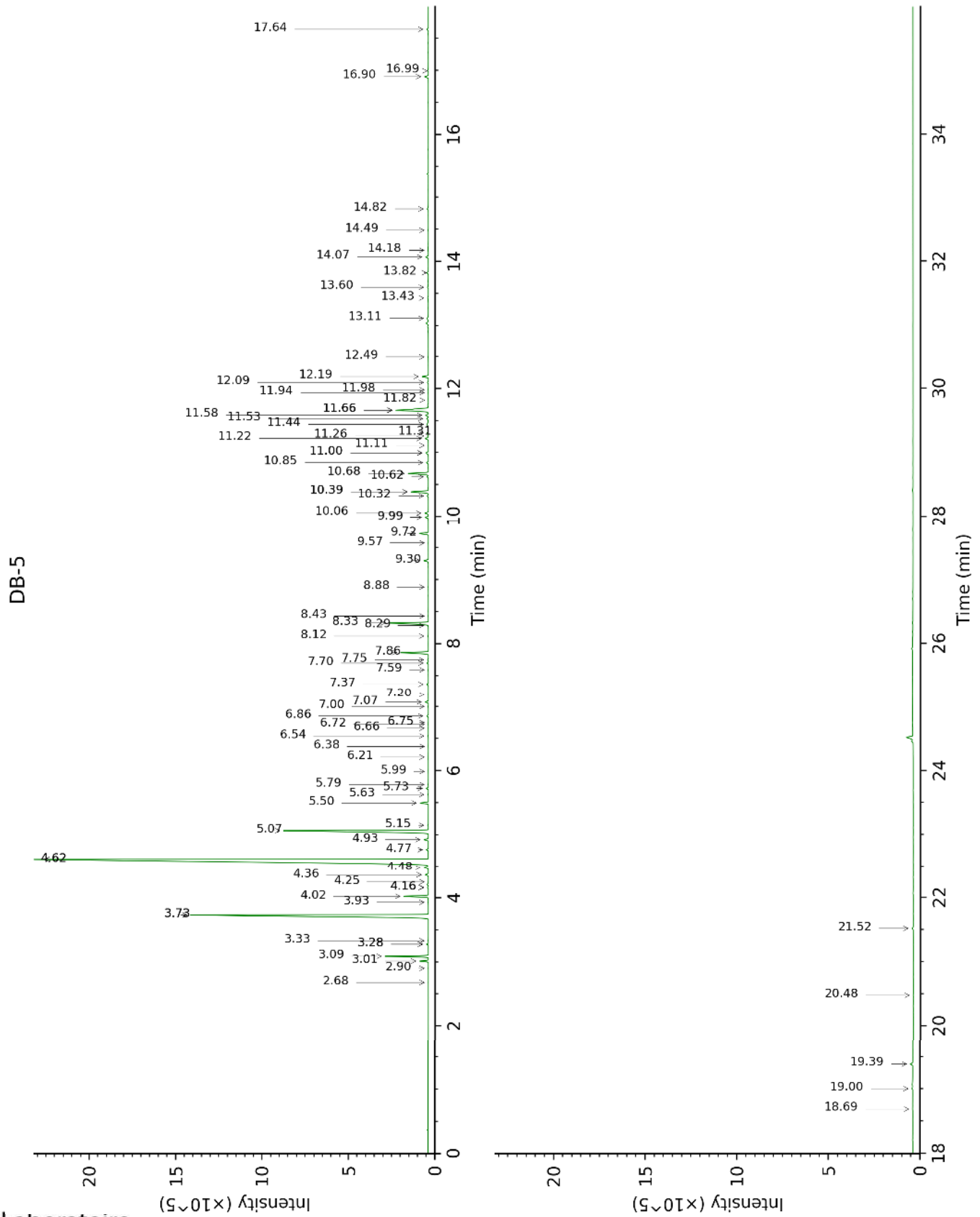
δ-Elemene	0.28	0.28	Sesquiterpene
Citronellyl acetate	0.01	[1.79]*	Monoterpenic ester
Neryl acetate	0.53	0.66*	Monoterpenic ester
Geranyl acetate	0.19	0.21*	Monoterpenic ester
β-Elemene	0.24	2.53*	Sesquiterpene
Dodecanal	0.07	0.05	Aliphatic aldehyde
β-Caryophyllene	1.11*	[2.53]*	Sesquiterpene
α-Santalene	[1.11]*	[0.13]*	Sesquiterpene
γ-Elemene	0.08	0.08	Sesquiterpene
<i>trans</i> -α-Bergamotene	1.28	[2.53]*	Sesquiterpene
α-Humulene	0.13	0.12	Sesquiterpene
(<i>E</i>)-β-Farnesene	0.18*	0.14	Sesquiterpene
β-Santalene	[0.18]*	0.06	Sesquiterpene
Selina-4,11-diene	0.01	[1.79]*	Sesquiterpene
Germacrene D	0.21	[0.44]*	Sesquiterpene
γ-Curcumene	0.06	0.03	Sesquiterpene
<i>trans</i> -β-Bergamotene	0.09	0.10	Sesquiterpene
Bicyclogermacrene	0.15*	2.72*	Sesquiterpene
α-Selinene	[0.15]*	0.06	Sesquiterpene
(3 <i>Z</i> ,6 <i>E</i>)-α-Farnesene	0.13	[0.66]*	Sesquiterpene
(<i>Z</i>)-α-Bisabolene	0.19	0.13	Sesquiterpene
β-Bisabolene	2.80*	[2.72]*	Sesquiterpene
γ-Cadinene	[2.80]*	0.01	Sesquiterpene
(3 <i>E</i> ,6 <i>E</i>)-α-Farnesene	[2.80]*	0.92*	Sesquiterpene
δ-Cadinene	0.01	[0.92]*	Sesquiterpene
Selina-4(15),7(11)-diene	0.03	[0.21]*	Sesquiterpene
Unknown	0.02	[0.21]*	Sesquiterpene
(<i>E</i>)-α-Bisabolene	0.07	0.07	Sesquiterpene
Germacrene B	0.40	0.42	Sesquiterpene
Caryophyllene oxide	0.03	0.02	Sesquiterpenic ether
Guaia-6,10(14)-dien-4β-ol	0.14	0.08	Sesquiterpenic alcohol
Unknown	0.07	0.06	Oxygenated sesquiterpene
Unknown	0.06	0.06	Oxygenated sesquiterpene
α-Bisabolol	0.12	0.10	Sesquiterpenic alcohol
Herniarin	0.18	0.19	Coumarin
(2 <i>E</i> ,6 <i>Z</i>)-Farnesal	0.04		Sesquiterpenic aldehyde
(2 <i>E</i> ,6 <i>E</i>)-Farnesal	0.03	0.03	Sesquiterpenic aldehyde
Myristic acid	0.10		Aliphatic acid
Citropten	0.26	0.27	Furanocoumarin
Palmitic acid	0.07		Aliphatic acid
Bergapten	0.11		Furanocoumarin
Linoleic acid	0.03		Aliphatic acid
Stearic acid	0.07		Aliphatic acid
Isopimpinellin	0.15		Furanocoumarin
Oxypeucedanin	0.01		Furanocoumarin
Heraclenin	0.09		Furanocoumarin
Total identified	97.20%	97.46%	

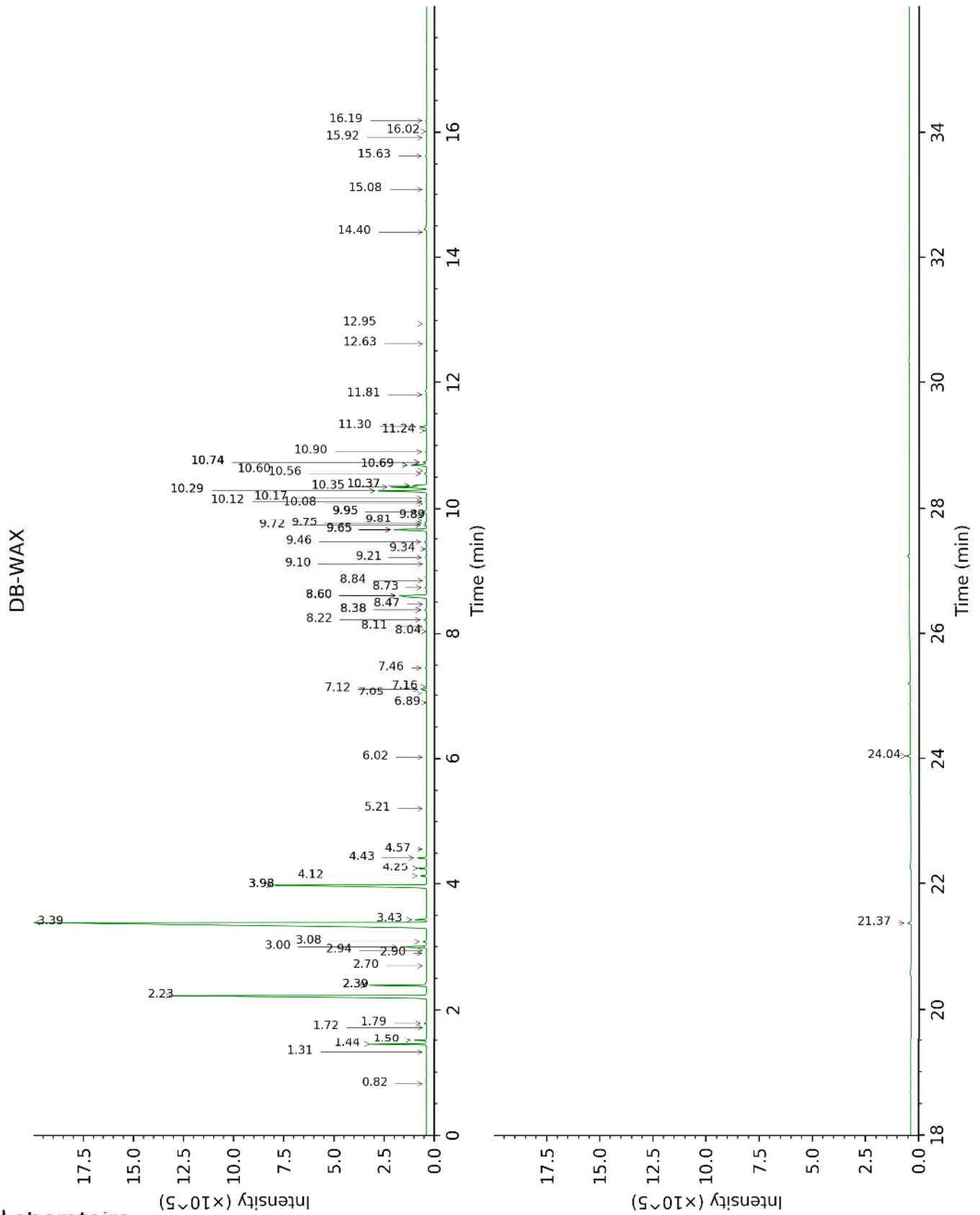
*: Two or more compounds are coeluting on this column

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

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	%
Nonane	2.68	903	0.01	0.82	891	0.01
Tricyclene	2.90	918	0.01	1.31	971	0.01
α -Thujene	3.01	925	0.41	1.50	998	0.39
α -Pinene	3.09	930	2.05	1.44	991	2.03
Camphene	3.28*	942	0.10	1.79	1026	0.09
α -Fenchene	3.28*	942	[0.10]	1.72	1019	0.01
Thuja-2,4(10)-diene	3.33	946	0.02	2.39*	1084	2.37
Sabinene	3.73*	973	19.19	2.39*	1084	[2.37]
β -Pinene	3.73*	973	[19.19]	2.23	1068	16.83
6-Methyl-5-hepten-2-one	3.93	986	0.03	5.21	1294	0.03
Myrcene	4.02	992	1.25	3.00	1132	1.26
α -Phellandrene	4.16*	1001	0.06	2.90	1125	0.04
Pseudolimonene	4.16*	1001	[0.06]	2.94	1128	0.01
Octanal	4.16*	1001	[0.06]	4.57	1248	0.02
Δ 3-Carene	4.25	1007	0.01	2.70	1109	0.01
α -Terpinene	4.36	1014	0.18	3.08	1139	0.18
para-Cymene	4.48	1021	0.39	4.24	1225	0.41
Limonene	4.62*	1030	47.63	3.39	1162	47.66
1,8-Cineole	4.62*	1030	[47.63]	3.43	1165	0.48
(Z)- β -Ocimene	4.77	1040	0.11	3.98*	1206	10.41
(E)- β -Ocimene	4.93	1050	0.26	4.12	1216	0.27
γ -Terpinene	5.07	1058	10.15	3.98*	1206	[10.41]
cis-Sabinene hydrate	5.15	1064	0.04	7.05	1426	0.05
Terpinolene	5.50	1086	0.44	4.43	1238	0.45
trans-Sabinene hydrate	5.63	1094	0.04	8.11	1505	0.04
Linalool	5.73	1100	0.12	8.22	1513	0.12
Nonanal	5.79	1104	0.03	6.02	1352	0.02
trans-para-Mentha-2,8-dien-1-ol	5.99	1117	0.02	9.10	1581	0.01
1-Terpineol	6.21	1132	0.01	8.47	1532	0.02
Epoxyterpinolene	6.38	1143	0.01	6.89	1414	0.01
Citronellal	6.54	1154	0.04	7.16	1434	0.04
Borneol	6.66	1162	0.01	9.95*	1648	0.44
trans- β -Terpineol	6.72	1165	0.02	9.81	1637	0.02
Isoneral	6.75	1167	0.01	8.04	1499	0.01
Terpinen-4-ol	6.86	1174	0.10	8.73	1552	0.10
Isogeranial	7.00	1184	0.03	8.38*	1525	0.13
α -Terpineol	7.07	1188	0.18	9.95*	1648	[0.44]
γ -Terpineol	7.20	1196	0.01	10.08	1659	0.01
Decanal	7.37	1208	0.09	7.46	1456	0.09
2,3-Epoxyneral?	7.59	1224	0.02			
Nerol	7.70	1231	0.08	11.24	1755	0.09
2,3-Epoxygeranial?	7.75	1234	0.05			

Neral	7.86	1242	1.68	9.65*	1624	1.79
Geraniol	8.12	1260	0.04	11.81	1804	0.05
<i>trans</i> -Ascaridole glycol	8.29	1272	0.02	14.40	2040	0.02
Geranial	8.33	1275	2.57	10.34	1680	2.13
Unknown [m/z 95, 67 (45), 41 (42), 110 (42), 43 (41), 59 (36)]	8.43	1282	0.02	12.63	1876	0.03
Undecanal	8.88	1307	0.02	8.84	1561	0.02
δ-Elemene	9.30	1337	0.28	7.12	1431	0.28
Citronellyl acetate	9.57	1356	0.01	9.65*	1624	[1.79]
Neryl acetate	9.72	1367	0.53	10.37*	1682	0.66
Geranyl acetate	9.99	1386	0.19	10.74*	1713	0.21
β-Elemene	10.06	1391	0.24	8.60*	1543	2.53
Dodecanal	10.32	1410	0.07	10.17	1666	0.05
β-Caryophyllene	10.39*	1415	1.11	8.60*	1543	[2.53]
α-Santalene	10.39*	1415	[1.11]	8.38*	1525	[0.13]
γ-Elemene	10.62	1432	0.08	9.21	1589	0.08
<i>trans</i> -α-Bergamotene	10.68	1436	1.28	8.60*	1543	[2.53]
α-Humulene	10.84	1449	0.13	9.46	1609	0.12
(<i>E</i>)-β-Farnesene	11.00*	1460	0.18	9.72	1630	0.14
β-Santalene	11.00*	1460	[0.18]	9.34	1600	0.06
Selina-4,11-diene	11.11	1469	0.01	9.65*	1624	[1.79]
Germacrene D	11.22	1477	0.21	9.95*	1648	[0.44]
γ-Curcumene	11.26	1480	0.06	9.89	1644	0.03
<i>trans</i> -β-Bergamotene	11.31	1483	0.09	9.75	1633	0.10
Bicyclogermacrene	11.44*	1493	0.15	10.28*	1676	2.72
α-Selinene	11.44*	1493	[0.15]	10.12	1662	0.06
(3 <i>Z</i> ,6 <i>E</i>)-α-Farnesene	11.53	1500	0.13	10.37*	1682	[0.66]
(<i>Z</i>)-α-Bisabolene	11.58	1504	0.19	10.56	1698	0.13
β-Bisabolene	11.66*	1510	2.80	10.28*	1676	[2.72]
γ-Cadinene	11.66*	1510	[2.80]	10.60	1702	0.01
(3 <i>E</i> ,6 <i>E</i>)-α-Farnesene	11.66*	1510	[2.80]	10.69*	1709	0.92
δ-Cadinene	11.82	1522	0.01	10.69*	1709	[0.92]
Selina-4(15),7(11)-diene	11.94	1532	0.03	10.74*	1713	[0.21]
Unknown [m/z 189, 204 (92), 161 (65), 133 (51), 105 (51), 91 (51), 119 (45)]	11.98	1535	0.02	10.74*	1713	[0.21]
(<i>E</i>)-α-Bisabolene	12.09	1544	0.07	10.90	1727	0.07
Germacrene B	12.19	1551	0.40	11.30	1760	0.42
Caryophyllene oxide	12.49	1576	0.03	12.95	1905	0.02
Guaia-6,10(14)-dien-4β-ol	13.11	1625	0.14	15.92	2189	0.08

Unknown [m/z 94, 43 (89), 41 (67), 122 (46), 69 (41)...222]	13.43	1652	0.07	15.08	2105	0.06
Unknown [m/z 69, 95 (100), 41 (89), 109 (68), 67 (61)...222]	13.60	1666	0.06	16.19	2217	0.06
α -Bisabolol	13.82	1684	0.12	15.63	2160	0.10
Herniarin	14.07	1705	0.18	21.37	2807	0.19
(2E,6Z)-Farnesal	14.18	1714	0.04			
(2E,6E)-Farnesal	14.49	1741	0.03	16.02	2199	0.03
Myristic acid	14.82	1770	0.10			
Citropten	16.90	1960	0.26	24.04	3162	0.27
Palmitic acid	16.99	1968	0.07			
Bergapten	17.64	2031	0.11			
Linoleic acid	18.69	2136	0.03			
Stearic acid	19.00	2168	0.07			
Isopimpinellin	19.39	2208	0.15			
Oxypeucedanin	20.48	2326	0.01			
Heraclenin	21.52	2443	0.09			
Total identified		97.20%			97.46%	
Total reported		97.37%			97.61%	

*: Two or more compounds are coeluting on this column

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

Note: no correction factor was applied

R.T.: Retention time (minutes)

R.I.: Retention index