

Date : March 16, 2021

CERTIFICATE OF ANALYSIS – GC PROFILING

SAMPLE IDENTIFICATION

Internal code : 21B23-FEP05

Customer identification : Citronella - Indonesia - 13266-07

Type : Essential oil

Source : *Cymbopogon winterianus*

Customer : Fern & Petal

ANALYSIS

Method: PC-MAT-014  - 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 : March 15, 2021

Checked and approved by :

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

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PHYSICOCHEMICAL DATA

Physical aspect: Faintly yellow viscous liquid

Refractive index: 1.4712 ± 0.0003 (20 °C; method PC-MAT-016)

CONCLUSION

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

ANALYSIS SUMMARY – CONSOLIDATED CONTENTS

New readers of similar reports are encouraged to read table footnotes at least once.

Identification	%	Class
Methylcyclopentane	tr	Alkane
Isovaleral	tr	Aliphatic aldehyde
2-Ethylfuran	tr	Furan
Unknown	0.01	Unknown
Unknown	0.01	Unknown
Tricyclene	0.02	Monoterpene
α -Thujene	tr	Monoterpene
α -Pinene	0.10	Monoterpene
Camphene	0.08	Monoterpene
Sabinene	0.01	Monoterpene
β -Pinene	0.01	Monoterpene
6-Methyl-5-hepten-2-one	0.08	Aliphatic ketone
Myrcene	0.07	Monoterpene
α -Phellandrene	0.01	Monoterpene
Octanal	0.01	Aliphatic aldehyde
α -Terpinene	0.01	Monoterpene
para-Cymene	0.01	Monoterpene
Limonene	2.67	Monoterpene
β -Phellandrene	0.04	Monoterpene
Unknown	0.04	Unknown
(Z)- β -Ocimene	0.48	Monoterpene
(E)- β -Ocimene	0.25	Monoterpene
2,6-Dimethyl-5-heptenal (melonal)	0.11	Aliphatic aldehyde
γ -Terpinene	0.02	Monoterpene
Octanol	0.03	Aliphatic alcohol
Terpinolene	0.06	Monoterpene
<i>trans</i> -Sabinene hydrate	0.01	Monoterpenic alcohol
Linalool	0.73	Monoterpenic alcohol
Nonanal	0.01	Aliphatic aldehyde
Unknown	0.01	Oxygenated monoterpene
<i>cis</i> -Rose oxide	0.01	Monoterpenic ether
<i>trans</i> -para-Mentha-2,8-dien-1-ol	0.01	Monoterpenic alcohol
<i>trans</i> -Rose oxide	0.01	Monoterpenic ether
Melonol ?	0.10	Normonoterpene
Isopulegol	0.85	Monoterpenic alcohol
Menthone	0.03	Monoterpenic ketone
Citronellal	33.05	Monoterpenic aldehyde
iso-Isopulegol	0.28	Monoterpenic alcohol
Borneol	0.08	Monoterpenic alcohol
Isoneral	0.01	Monoterpenic aldehyde
neoiso-Isopulegol	0.15	Monoterpenic alcohol
Isopulegol isomer	0.05	Monoterpenic alcohol
Terpinen-4-ol	0.04	Monoterpenic alcohol
Rosefuran oxide	0.02	Monoterpenic ether
α -Terpineol	0.07	Monoterpenic alcohol

Unknown	0.01	Unknown
(4Z)-Decenal	0.04	Aliphatic aldehyde
Decanal	0.12	Aliphatic aldehyde
2,3-Epoxyneral?	0.02	Monoterpenic aldehyde
Nerol	0.18	Monoterpenic alcohol
Citronellol	9.46	Monoterpenic alcohol
Neral	0.56	Monoterpenic aldehyde
Piperitone	0.02	Monoterpenic ketone
Geraniol	23.72	Monoterpenic alcohol
Geranial	0.80	Monoterpenic aldehyde
Citronellyl formate	0.06	Monoterpenic ester
Geranyl formate	0.08	Monoterpenic ester
Unknown	0.03	Norsesquiterpene
Citronellic acid	0.17	Monoterpenic acid
8-Hydroxy-neo-menthol	0.16	Monoterpenic alcohol
δ -Elemene isomer	0.03	Sesquiterpene
α -Cubebene	0.02	Sesquiterpene
Citronellyl acetate	2.63	Monoterpenic ester
Eugenol	0.67	Phenylpropanoid
Neryl acetate	0.09	Monoterpenic ester
α -Copaene	0.04	Sesquiterpene
β -Bourbonene	0.06	Sesquiterpene
<i>cis</i> - β -Elemene	0.04	Sesquiterpene
Geranyl acetate	4.23	Monoterpenic ester
β -Cubebene	0.03	Sesquiterpene
β -Elemene	0.97	Sesquiterpene
Methyleugenol	0.09	Phenylpropanoid
Dodecanal	0.03	Aliphatic aldehyde
β -Caryophyllene	1.28	Sesquiterpene
β -Copaene	0.03	Sesquiterpene
<i>trans</i> - α -Bergamotene	0.16	Sesquiterpene
Isogermacrene D	0.03	Sesquiterpene
α -Humulene	0.32	Sesquiterpene
(<i>E</i>)-Isoeugenol	0.04	Phenylpropanoid
<i>trans</i> -Cadina-1(6),4-diene	0.06	Sesquiterpene
γ -Murolene	0.18	Sesquiterpene
Germacrene D	1.65	Sesquiterpene
α -Selinene	0.01	Sesquiterpene
epi-Cubebol	0.14	Sesquiterpenic alcohol
α -Murolene	0.34	Sesquiterpene
Methyl (<i>E</i>)-isoeugenol	0.54	Phenylpropanoid
Germacrene A	0.78	Sesquiterpene
γ -Cadinene	0.16	Sesquiterpene
Cubebol	0.24	Sesquiterpenic alcohol
δ -Cadinene	1.44	Sesquiterpene
<i>trans</i> -Calamenene	0.05	Sesquiterpene
Unknown	0.05	Sesquiterpene
10-epi-Cubebol?	0.09	Sesquiterpenic alcohol
α -Cadinene	0.10	Sesquiterpene
α -Elemol	1.88	Sesquiterpenic alcohol
Geranyl butyrate	0.39	Monoterpenic ester
Germacrene D-4-ol	0.82	Sesquiterpenic alcohol

Caryophyllene oxide	0.08	Sesquiterpenic ether
Caryophyllene oxide isomer	0.02	Sesquiterpenic ether
10-epi-Cubenol	0.10	Sesquiterpenic alcohol
Unknown	0.07	Unknown
γ-Eudesmol	0.17	Sesquiterpenic alcohol
τ-Muurolol	0.24	Sesquiterpenic alcohol
τ-Cadinol	0.14	Sesquiterpenic alcohol
α-Muurolol	0.08	Sesquiterpenic alcohol
β-Eudesmol	0.14	Sesquiterpenic alcohol
α-Eudesmol	0.15	Sesquiterpenic alcohol
α-Cadinol	0.55	Sesquiterpenic alcohol
Unknown	0.37	Unknown
7-epi-γ-Eudesmol	0.24	Sesquiterpenic alcohol
(2E,6E)-Farnesol	0.06	Sesquiterpenic alcohol
(2E,6E)-Farnesol	0.02	Sesquiterpenic aldehyde
Cryptomeridiol	0.01	Sesquiterpenic alcohol
Geranyl caprylate	0.02	Monoterpenic ester
Unknown	0.07	Oxygenated diterpene
Unknown	0.01	Unknown
Unknown	0.03	Unknown
Unknown	0.09	Unknown
Unknown	0.13	Unknown
Consolidated total	97.58%	

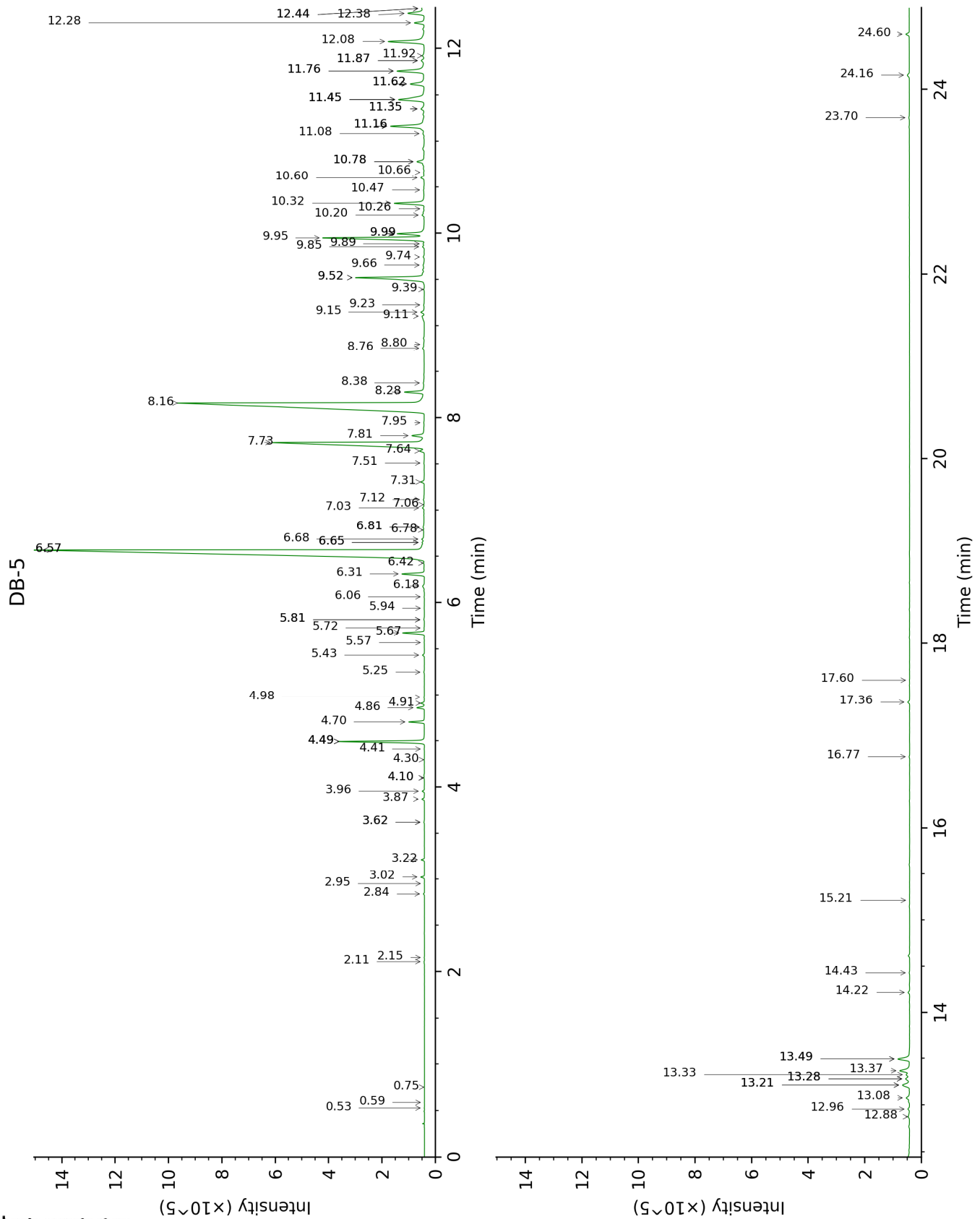
tr: The compound has been detected below 0.005% of total signal.

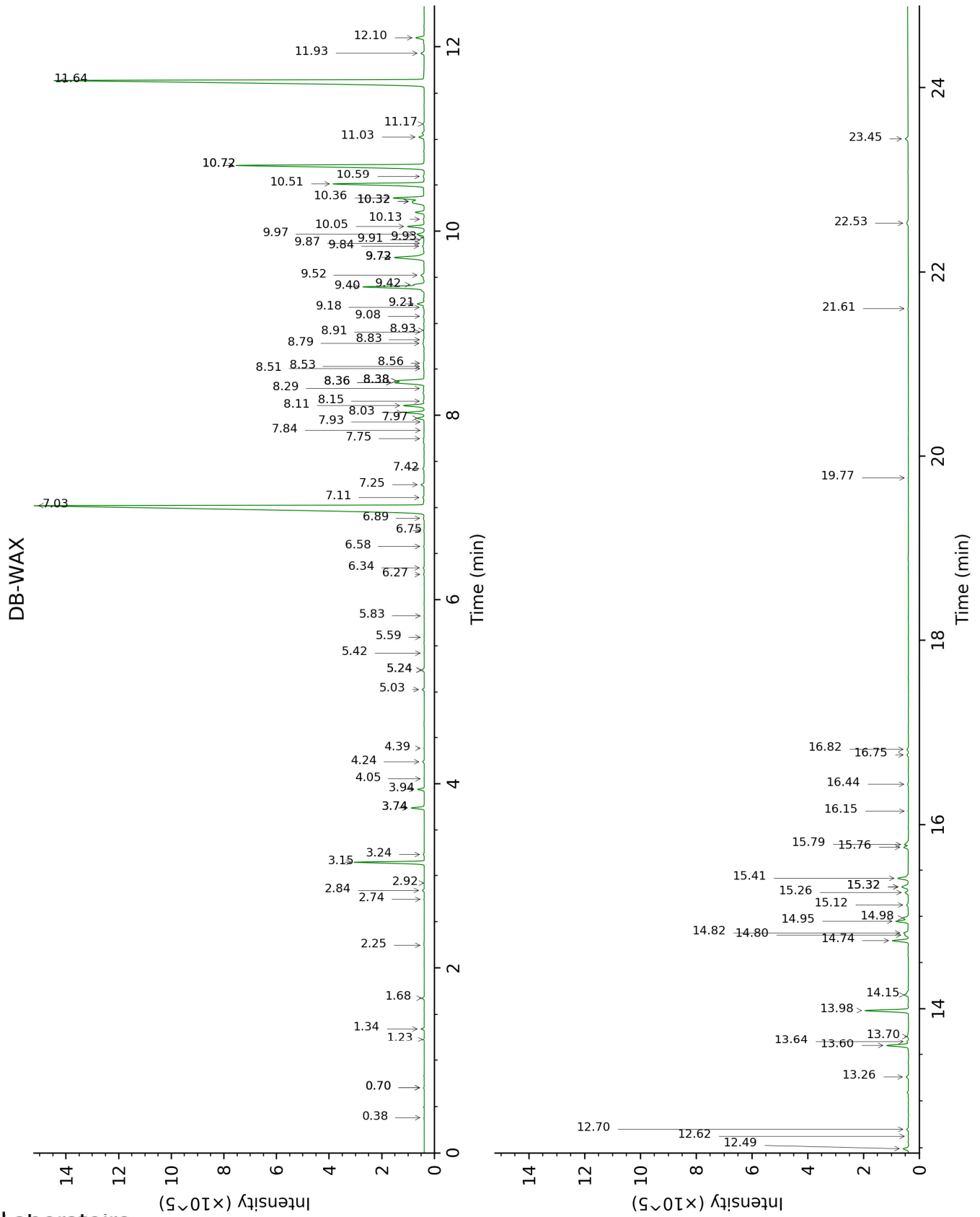
Note: no correction factor was applied

About "consolidated" data: The table above presents the breakdown of the sample volatile constituents after applying an algorithm to collapse data acquired from the multi-columns system of PhytoChemia into a single set of consolidated contents. In case of discrepancies between columns, the algorithm is set to prioritize data from the most standard DB-5 column, and smallest values so as to avoid overestimating individual content. This process is semi-automatic. Advanced users are invited to consult the "Full analysis data" table after the chromatograms in this report to access the full untreated data and perform their own calculations if needed.

Unknowns: Unknown compounds' mass spectral data is presented in the "Full analysis data" table. The occurrence of unknown compounds is to be expected in many samples, and does not denote particular problems unless noted otherwise in the conclusion.

This page was intentionally left blank. The following pages present the complete data of the analysis.





FULL ANALYSIS DATA

Identification	Column DB-5			Column DB-WAX		
	R.T	R.I	%	R.T	R.I	%
Methylcyclopentane	0.53	619	tr	0.38	663	0.01
Isovaleral	0.59	642	tr			
2-Ethylfuran	0.75	703	tr			
Unknown [m/z 55, 83 (89), 82 (70), 67 (66), 41 (55), 69 (46), 111 (37)... 126 (2)]	2.11	860	0.01	0.70*	869	0.02
Unknown [m/z 55, 83 (79), 67 (65), 41 (63), 82 (60), 69 (58)... 111 (27), 126 (9)]	2.15	864	0.01	0.70*	869	[0.02]
Tricyclene	2.84	917	0.02	1.23	972	0.02
α -Thujene	2.95	925	tr			
α -Pinene	3.02	930	0.10	1.34	991	0.10
Camphene	3.22	942	0.08	1.68	1027	0.09
Sabinene	3.62*	969	0.02	2.25	1083	0.01
β -Pinene	3.62*	969	[0.02]			
6-Methyl-5-hepten-2-one	3.87	986	0.08	5.03	1296	0.08
Myrcene	3.96	992	0.07	2.84	1133	0.06
α -Phellandrene	4.10*†	1001	0.03	2.74	1126	0.01
Octanal	4.10*†	1001	[0.03]	4.39	1249	0.01
α -Terpinene	4.30	1014	0.01	2.92	1139	tr
para-Cymene	4.41	1021	0.01	4.06	1226	0.01
Limonene	4.49*	1026	2.72	3.15	1157	2.67
β -Phellandrene	4.49*	1026	[2.72]	3.24	1164	0.04
Unknown [m/z 59, 43 (12), 109 (11), 41 (10), 127 (8)...]	4.49*	1026	[2.72]	6.34	1391	0.04
(Z)- β -Ocimene	4.70	1039	0.48	3.74*	1203	0.50
(E)- β -Ocimene	4.86	1049	0.25	3.94	1217	0.24
2,6-Dimethyl-5-heptenal (melonal)	4.91	1052	0.11	5.24*	1311	0.12
γ -Terpinene	4.98	1056	0.02	3.74*	1203	[0.50]
Octanol	5.25	1074	0.03	8.15	1527	0.04
Terpinolene	5.43	1085	0.06	4.24	1239	0.07
trans-Sabinene hydrate	5.57	1094	0.01	7.93	1509	0.01
Linalool	5.67	1100	0.73	8.03	1517	0.76
Nonanal	5.72	1104	0.01	5.82	1353	0.01
Unknown [m/z 111, 69 (70), 41 (68), 55 (53), 43 (51)... 154 (7)]	5.81*	1110	0.02	5.59	1337	0.01
cis-Rose oxide	5.81*	1110	[0.02]	5.24*	1311	[0.12]
trans-para-Mentha-2,8-dien-1-ol	5.94	1118	0.01	8.91	1586	0.02

<i>trans</i> -Rose oxide	6.06	1126	0.01	5.42	1324	0.01
Melonol ?	6.18	1133	0.10			
Isopulegol	6.31	1141	0.85	8.11	1523	0.92
Menthone	6.42	1149	0.03	6.58	1408	0.03
Citronellal	6.57*	1158	33.49	7.02	1442	33.05
iso-Isopulegol	6.57*	1158	[33.49]	7.97	1513	0.28
Borneol	6.65*	1163	0.09	9.72*	1651	1.81
Isoneral	6.65*	1163	[0.09]	7.84	1502	0.01
neoiso-Isopulegol	6.68	1166	0.15	8.79	1576	0.09
Isopulegol isomer	6.78	1172	0.05	8.53	1556	0.04
Terpinen-4-ol	6.81*	1174	0.09	8.56	1559	0.04
Rosefuran oxide	6.81*	1174	[0.09]	8.51	1554	0.02
α -Terpineol	7.03	1188	0.07	9.72*	1651	[1.81]
Unknown [m/z 43, 81 (47), 67 (45), 69 944), 41 (42), 59 (40), 55 (39)...]	7.06	1190	0.01	9.08	1599	0.04
(4Z)-Decenal	7.12	1194	0.04			
Decanal	7.31	1206	0.12	7.25	1458	0.12
2,3-Epoxyneral?	7.51	1220	0.02			
Nerol	7.64	1229	0.18	11.03	1760	0.26
Citronellol	7.73	1235	9.46	10.72*	1734	9.70
Neral	7.81	1240	0.56	9.42†	1627	[3.18]
Piperitone	7.95	1250	0.02	9.87	1663	0.03
Geraniol	8.16	1264	23.72	11.64	1812	23.90
Geranial	8.28	1272	0.80	10.05	1678	0.71
Citronellyl formate	8.38	1279	0.06	8.83	1579	0.04
Geranyl formate	8.76	1305	0.08	9.84	1661	0.09
Unknown [m/z 135, 121 (81), 177 (78), 107 (60), 192 (42), 149 (35)]	8.80	1308	0.03	6.27	1386	0.03
Citronellic acid	9.10	1330	0.17	15.79	2205	0.19
8-Hydroxy-neo-menthol	9.15	1333	0.16	14.15	2044	0.20
δ -Elemene isomer	9.23	1334	0.03	6.89	1431	0.04
α -Cubebene	9.39	1346	0.02	6.75	1421	0.02
Citronellyl acetate	9.52*	1355	3.32	9.40†	1625	3.18
Eugenol	9.52*	1355	[3.32]	14.74	2100	0.67
Neryl acetate	9.66	1364	0.09	10.13	1684	0.04
α -Copaene	9.74	1370	0.04	7.11	1448	0.05
β -Bourbonene	9.85	1378	0.06	7.42	1471	0.06
<i>cis</i> - β -Elemene	9.89	1380	0.04	8.29	1538	0.05
Geranyl acetate	9.95	1385	4.23	10.51	1716	4.33
β -Cubebene	10.00*	1388	1.19	7.75	1496	0.03
β -Elemene	10.00*	1388	[1.19]	8.38*†	1544	[2.44]
Methyleugenol	10.20	1402	0.09	13.26	1961	0.11
Dodecanal	10.26	1407	0.03	9.93	1668	0.02
β -Caryophyllene	10.32	1412	1.28	8.38*†	1544	[2.44]
β -Copaene	10.47	1422	0.03	8.36*†	1543	2.44
<i>trans</i> - α -Bergamotene	10.60	1432	0.16	8.36*†	1543	[2.44]

Isogermacrene D	10.66	1437	0.03	8.93	1587	0.02
α -Humulene	10.78*	1446	0.40	9.22	1610	0.32
(<i>E</i>)-Isoeugenol	10.78*	1446	[0.40]	16.44	2272	0.04
<i>trans</i> -Cadina-1(6),4-diene	11.08	1468	0.06	9.18	1607	0.05
γ -Muurolene	11.16*	1474	1.83	9.52	1635	0.18
Germacrene D	11.16*	1474	[1.83]	9.72*	1651	[1.81]
α -Selinene	11.35*	1488	0.19	9.91	1666	0.01
epi-Cubebol	11.35*	1488	[0.19]	11.93	1838	0.14
α -Muurolene	11.45*	1495	1.66	9.97	1671	0.34
Methyl (<i>E</i>)-isoeugenol	11.45*	1495	[1.66]	14.95	2121	0.54
Germacrene A	11.45*	1495	[1.66]	10.32*†	1700	0.94
γ -Cadinene	11.62*	1508	0.73	10.32*†	1700	[0.94]
Cubebol	11.62*	1508	[0.73]	12.49	1888	0.24
δ -Cadinene	11.76*	1519	1.44	10.36	1703	1.44
<i>trans</i> -Calamenene	11.76*	1519	[1.44]	11.17	1772	0.05
Unknown [m/z 119, 105 (53), 161 (33), 93 (28), 91 (25), 40 (20)...204]	11.87*	1528	0.16	10.59	1723	0.05
10-epi-Cubebol?	11.87*	1528	[0.16]	13.70	2001	0.09
α -Cadinene	11.92	1532	0.10	10.72*	1734	[9.70]
α -Elemol	12.08	1544	1.88	13.98	2028	1.85
Geranyl butyrate	12.28	1560	0.39	12.10	1853	0.39
Germacrene D-4-ol	12.38	1568	0.82	13.60	1992	0.97
Caryophyllene oxide	12.44*	1572	0.16	12.70	1909	0.08
Caryophyllene oxide isomer	12.44*	1572	[0.16]	12.62	1902	0.02
10-epi-Cubenol	12.88	1607	0.10	13.64	1996	0.07
Unknown [m/z 69, 41 (42), 109 (25), 123 (22), 64 (22), 179 (18)...]	12.96	1614	0.07			
γ -Eudesmol	13.08	1624	0.17	14.82	2109	0.20
τ -Muurolol	13.22*	1635	0.42	14.98	2125	0.24
τ -Cadinol	13.22*	1635	[0.42]	14.80	2106	0.14
α -Muurolol	13.28*	1640	0.22	15.12	2139	0.08
β -Eudesmol	13.28*	1640	[0.22]	15.32*	2158	0.38
α -Eudesmol	13.33	1644	0.15	15.26	2152	0.14
α -Cadinol	13.37	1648	0.55	15.41	2167	0.54
Unknown, not seen in MS	13.50*	1658	0.61			
7-epi- γ -Eudesmol	13.50*	1658	[0.61]	15.32*	2158	[0.38]
(2 <i>E</i> ,6 <i>E</i>)-Farnesol	14.22	1718	0.06	16.76	2305	0.07
(2 <i>E</i> ,6 <i>E</i>)-Farnesal	14.43	1737	0.02	15.76	2202	0.21
Cryptomeridiol	15.21	1804	0.01	19.77	2646	0.02
Geranyl caprylate	16.77	1947	0.02	16.15	2242	0.03
Unknown [m/z 41, 69 (98), 55 (55), 81	17.36	2004	0.07	16.82	2312	0.07

(46), 109 (46)... 290 (8)] Unknown [m/z 69, 41 (96), 55 (53), 109 (48), 95 (43), 67 (35)...]	17.60	2027	0.01			
Unknown [m/z 69, 81 (79), 81 (70), 137 (53), 139 (35), 95 (30)...]	23.70	2707	0.03	21.60	2875	0.03
Unknown [m/z 69, 81 (84), 137 (53), 83 (30), 95 (27), 41 (19)...]	24.16	2766	0.09	22.53	2997	0.10
Unknown [m/z 69, 81 (64), 95 (29), 137 (19), 41 (19)...]	24.60	2824	0.13	23.45	3124	0.14
Total identified		98.01%			97.31%	
Total reported		98.47%			97.82%	

*: Two or more compounds are coeluting on this column

[xx]: Duplicate percentage due to coelutions, not taken into account in the consolidated 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