

Date : October 21, 2020

CERTIFICATE OF ANALYSIS – GC PROFILING

SAMPLE IDENTIFICATION

Internal code : 20J16-PTH09

Customer identification : Tea Tree - Australia - T2010999R

Type : Essential oil

Source : *Melaleuca alternifolia* ct. Terpinen-4-ol

Customer : Plant Therapy

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 : October 21, 2020

Checked and approved by :

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

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PHYSICOCHEMICAL DATA

Physical aspect: Clear liquid

Refractive index: 1.4777 ± 0.0003 (20 °C; method PC-MAT-016)

ISO 4730:2017 - TEA TREE OIL

Compound	Min. %	Max. %	Observed %	Complies?
Viridiflorol	tr	1.0	0.1	Yes
Globulol	tr	1.0	0.2	Yes
δ-Cadinene	0.2	3.0	1.0	Yes
Viridiflorene	0.1	3.0	0.9	Yes
Aromadendrene	0.2	3.0	1.0	Yes
α-Terpineol	2.0	5.0	2.9	Yes
Terpinen-4-ol	35.0	48.0	42.6	Yes
Terpinolene	1.5	5.0	3.3	Yes
γ-Terpinene	14.0	28.0	20.1	Yes
1,8-Cineole	tr	10.0	2.3	Yes
para-Cymene	0.5	8.0	2.6	Yes
Limonene	0.5	1.5	0.8	Yes
α-Terpinene	6.0	12.0	9.1	Yes
Sabinene	tr	3.5	0.1	Yes
α-Pinene	1.0	4.0	2.4	Yes
Refractive index	1.4750	1.4820	1.4777	Yes

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
Ethanol	0.12	Aliphatic alcohol
Isobutyral	0.03	Aliphatic aldehyde
Ethyl acetate	0.01	Aliphatic ester
Isobutanol	tr	Aliphatic alcohol
Isovaleral	tr	Aliphatic aldehyde
2-Methylbutyral	0.02	Aliphatic aldehyde
Isoamyl alcohol	tr	Aliphatic alcohol
2-Methylbutanol	tr	Aliphatic alcohol
(3Z)-Hexenol	0.03	Aliphatic alcohol
Hexanol	0.01	Aliphatic alcohol
α -Thujene	0.85	Monoterpene
α -Pinene	2.40	Monoterpene
Camphene	0.01	Monoterpene
α -Fenchene	tr	Monoterpene
β -Pinene	0.70	Monoterpene
Sabinene	0.10	Monoterpene
3-Methyl-3-cyclohexenone	0.01	Aliphatic ketone
Myrcene	0.80	Monoterpene
Pseudolimonene	0.01	Monoterpene
α -Phellandrene	0.44	Monoterpene
(3Z)-Hexenyl acetate	0.01	Aliphatic ester
α -Terpinene	9.12	Monoterpene
Carvomenthene	0.01	Aliphatic alcohol
para-Cymene	2.56	Monoterpene
Limonene	0.83	Monoterpene
1,8-Cineole	2.28	Monoterpenic ether
β -Phellandrene	0.76	Monoterpene
(Z)- β -Ocimene	tr	Monoterpene
(E)- β -Ocimene	0.02	Monoterpene
γ -Terpinene	20.10	Monoterpene
cis-Sabinene hydrate	0.04	Monoterpenic alcohol
Terpinolene	3.26	Monoterpene
para-Cymenene	0.06	Monoterpene
trans-Sabinene hydrate	0.03	Monoterpenic alcohol
Linalool	0.06	Monoterpenic alcohol
Unknown	tr	Monoterpenic alcohol
endo-Fenchol	0.02	Monoterpenic alcohol
cis-para-Menth-2-en-1-ol	0.18	Monoterpenic alcohol
4-Hydroxy-4-methylcyclohex-2-enone	0.02	Aliphatic alcohol
Cosmene isomer I	0.02	Monoterpene
trans-para-Menth-2-en-1-ol	0.10	Monoterpenic alcohol
Camphene hydrate	0.01	Monoterpenic alcohol
Unknown	0.03	Unknown
δ -Terpineol	0.01	Monoterpenic alcohol
Terpinen-4-ol	42.59	Monoterpenic alcohol

Dill ether	0.01	Monoterpenic ether
para-Cymen-8-ol	0.09	Monoterpenic alcohol
α -Terpineol	2.95	Monoterpenic alcohol
<i>cis</i> -Piperitol	0.05	Monoterpenic alcohol
<i>trans</i> -Piperitol	0.12	Monoterpenic alcohol
endo-Fenchyl acetate	0.01	Monoterpenic ester
exo-2-Hydroxycineole	0.02	Monoterpenic alcohol
Nerol	0.02	Monoterpenic alcohol
Unknown	0.02	Oxygenated monoterpene
Piperitone	0.04	Monoterpenic ketone
<i>cis</i> -Carvenone oxide?	0.01	Monoterpenic ketone
<i>trans</i> -Ascaridole glycol	0.05	Monoterpenic alcohol
<i>cis</i> -Ascaridole glycol	0.05	Monoterpenic alcohol
Thymol	0.02	Monoterpenic alcohol
Carvacrol	0.02	Monoterpenic alcohol
Unknown	0.05	Monoterpenic alcohol
Bicycloelemene	0.01	Sesquiterpene
α -Cubebene	0.06	Sesquiterpene
Isoledene	0.06	Sesquiterpene
α -Copaene	0.10	Sesquiterpene
7-Cubebene	0.05	Sesquiterpene
7-Cubebene epimer?	0.02	Aliphatic alcohol
β -Cubebene	0.02	Sesquiterpene
β -Elemene	0.02	Sesquiterpene
Unknown	0.02	Sesquiterpene
α -Gurjunene	0.31	Sesquiterpene
Methyleugenol	0.03	Phenylpropanoid
β -Maaliene	0.02	Sesquiterpene
β -Caryophyllene	0.32	Sesquiterpene
γ -Maaliene	0.07	Sesquiterpene
α -Maaliene	0.07	Sesquiterpene
Aromadendrene	1.03	Sesquiterpene
Selina-5,11-diene	0.13	Sesquiterpene
<i>trans</i> -Muurolo-3,5-diene	0.10	Sesquiterpene
α -Humulene	0.08	Sesquiterpene
allo-Aromadendrene	0.46	Sesquiterpene
Valerena-4,7(11)-diene	0.04	Sesquiterpene
γ -Gurjunene	0.05	Sesquiterpene
<i>trans</i> -Cadina-1(6),4-diene	0.28	Sesquiterpene
Selina-4,11-diene	0.03	Sesquiterpene
γ -Muurolole	0.01	Sesquiterpene
Germacrene D	0.01	Sesquiterpene
β -Selinene	0.09	Sesquiterpene
allo-Aromadendr-9-ene	0.09	Sesquiterpene
<i>trans</i> -Muurolo-4(15),5-diene	0.06	Sesquiterpene
δ -Selinene	0.10	Sesquiterpene
α -Selinene	0.10	Sesquiterpene
Bicyclogermacrene	0.41	Sesquiterpene
Viridiflorene	0.86	Sesquiterpene
Epizonarene	0.01	Sesquiterpene
α -Muurolole	0.14	Sesquiterpene
γ -Cadinene	0.04	Sesquiterpene

<i>trans</i> -Calamenene	0.10	Sesquiterpene
δ -Cadinene	0.95	Sesquiterpene
Zonarene	0.22	Sesquiterpene
<i>trans</i> -Cadina-1,4-diene	0.16	Sesquiterpene
α -Calacorene	0.02	Sesquiterpene
Epiglobulol	0.06	Sesquiterpenic alcohol
Eudesma-5,7(11)-diene	0.01	Sesquiterpene
Maaliol	0.03	Sesquiterpenic alcohol
Unknown	0.01	Oxygenated sesquiterpene
Palustrol	0.05	Sesquiterpenic alcohol
Unknown	0.01	Oxygenated sesquiterpene
Spathulenol	0.07	Sesquiterpenic alcohol
Globulol	0.24	Sesquiterpenic alcohol
Gleenol	0.02	Sesquiterpenic alcohol
Viridiflorol	0.13	Sesquiterpenic alcohol
Cubeban-11-ol	0.10	Sesquiterpenic alcohol
Ledol	0.04	Sesquiterpenic alcohol
Eudesm-5-en-11-ol analog	0.07	Sesquiterpenic alcohol
Eudesm-5-en-11-ol	0.01	Sesquiterpenic alcohol
10-epi-Cubenol	0.01	Sesquiterpenic alcohol
Rosifoliol	0.10	Sesquiterpenic alcohol
1-epi-Cubenol	0.14	Sesquiterpenic alcohol
Isospathulenol	0.05	Sesquiterpenic alcohol
Cubenol	0.08	Sesquiterpenic alcohol
α -Muurolol	0.03	Sesquiterpenic alcohol
α -Cadinol	0.01	Sesquiterpenic alcohol
Consolidated total	99.21%	

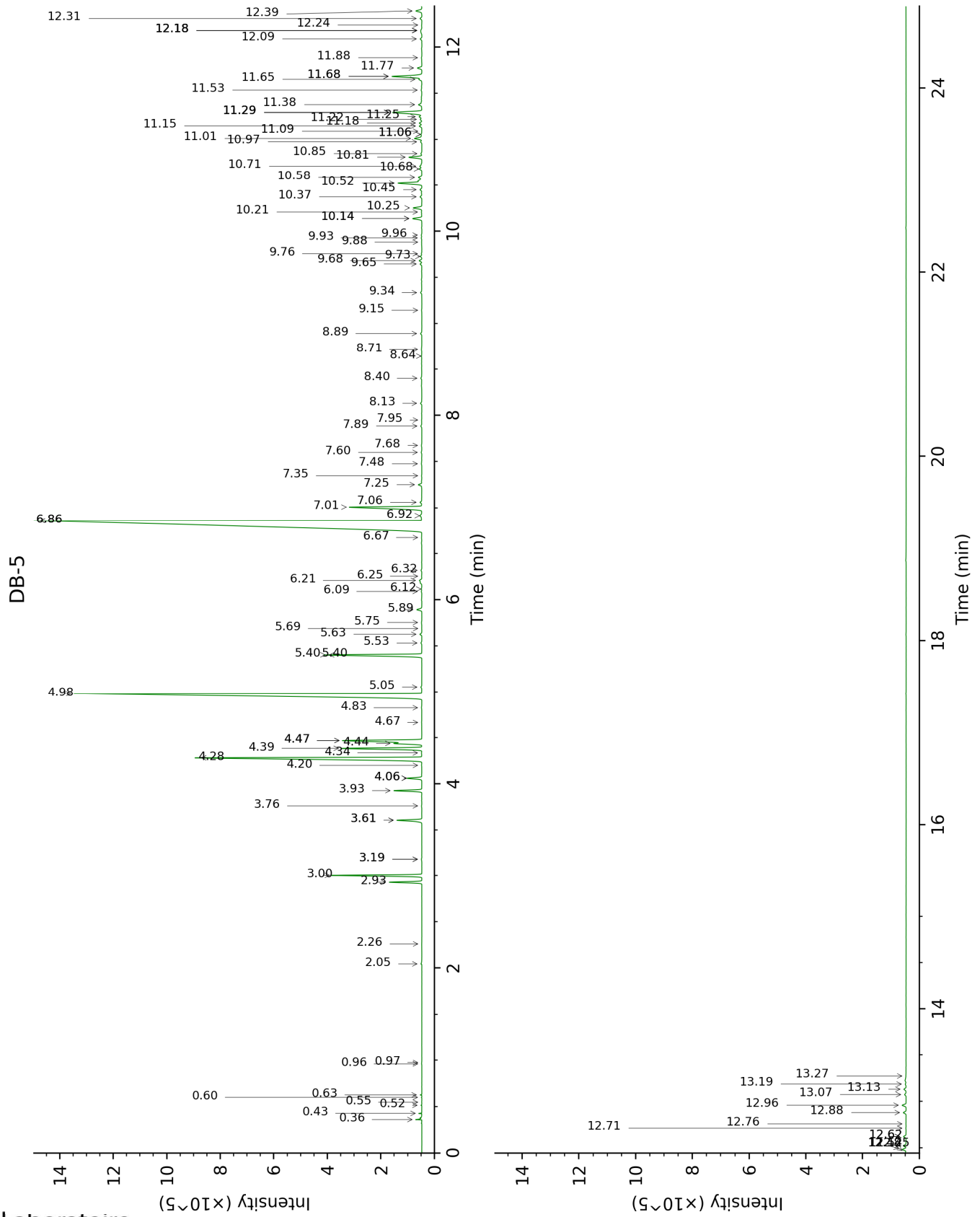
tr: The compound has been detected below 0.005% of total signal.

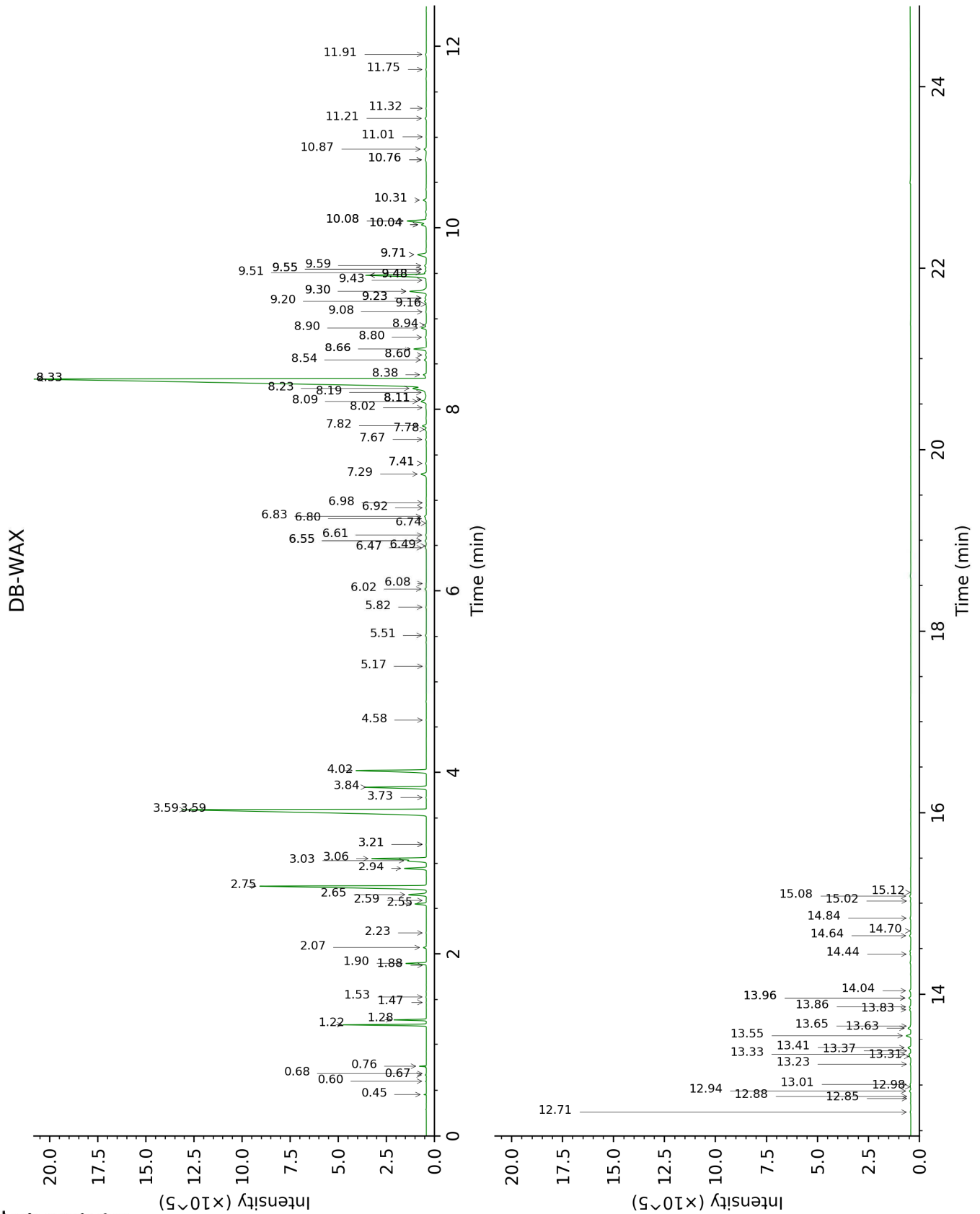
Note: no correction factor was applied

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	%
Ethanol	0.36	506	0.12	0.76	909	0.12
Isobutyral	0.43	536	0.03	0.45	782	0.03
Ethyl acetate	0.52	609	0.01	0.60	853	0.01
Isobutanol	0.55	622	tr	1.88	1064	tr
Isovaleral	0.60	642	tr	0.68	888	tr
2-Methylbutyral	0.63	652	0.02	0.67	882	0.02
Isoamyl alcohol	0.96	734	tr	3.21*	1181	0.01
2-Methylbutanol	0.97	736	tr	3.21*	1181	[0.01]
(3Z)-Hexenol	2.05	856	0.03	5.51	1350	0.04
Hexanol	2.26	874	0.01	5.17	1325	0.01
α -Thujene	2.93	925	0.85	1.28	1001	0.85
α -Pinene	3.00	930	2.40	1.22	993	2.40
Camphene	3.19*	942	0.02	1.53	1027	0.01
α -Fenchene	3.19*	942	[0.02]	1.47	1021	tr
β -Pinene	3.61*	971	0.80	1.90	1066	0.70
Sabinene	3.61*	971	[0.80]	2.07	1084	0.10
3-Methyl-3-cyclohexenone	3.76	981	0.01	5.82	1372	0.02
Myrcene	3.93	992	0.80	2.65	1135	0.80
Pseudolimonene	4.06*	1001	0.45	2.59	1130	0.01
α -Phellandrene	4.06*	1001	[0.45]	2.55	1127	0.44
(3Z)-Hexenyl acetate	4.20	1010	0.01	4.58	1285	0.01
α -Terpinene	4.28	1015	9.12	2.74	1143	9.12
Carvomenthene	4.34	1018	0.01	2.23	1101	0.01
para-Cymene	4.39	1022	2.56	3.84	1230	2.56
Limonene	4.44	1025	0.83	2.94	1159	0.85
1,8-Cineole	4.47*	1027	3.05	3.06	1168	2.28
β -Phellandrene	4.47*	1027	[3.05]	3.03	1166	0.76
(Z)- β -Ocimene	4.66	1039	tr	3.59*	1211	20.07
(E)- β -Ocimene	4.82	1050	0.02	3.73	1221	0.01
γ -Terpinene	4.98	1059	20.10	3.59*	1211	[20.07]
cis-Sabinene hydrate	5.06	1064	0.04	6.61	1431	0.04
Terpinolene	5.40*	1086	3.32	4.02	1243	3.26
para-Cymenene	5.40*	1086	[3.32]	6.02	1387	0.06
trans-Sabinene hydrate	5.53	1094	0.03	7.67	1511	0.03
Linalool	5.63	1100	0.06	7.78	1519	0.07
Unknown [m/z 119, 109 (94), 43 (61), 95 (56), 91 (48), 77 (32), 152 (32), 137 (31), 134 (24)]	5.69	1104	tr	8.11*†	1545	[0.39]
endo-Fenchol	5.75	1108	0.02	8.02	1538	0.02
cis-para-Menth-2-en-1-ol	5.89	1118	0.18	7.82	1522	0.18

4-Hydroxy-4-methylcyclohex-2-enone	6.09	1130	0.02	13.65	2025	0.02
Cosmene isomer I	6.12	1132	0.02	6.08	1391	0.01
<i>trans</i> -para-Menth-2-en-1-ol	6.21	1138	0.10	8.66*	1588	0.60
Camphene hydrate	6.25	1141	0.01	8.11*†	1545	[0.39]
Unknown [m/z 109, 124 (45), 119 (41), 43 (35), 91 (28), 95 (25)...]	6.32	1145	0.03	6.55*	1426	0.07
δ-Terpineol	6.67	1168	0.01	9.16	1628	0.01
Terpinen-4-ol	6.86*	1180	42.76	8.33*	1562	42.66
Dill ether	6.86*	1180	[42.76]	6.98	1458	0.01
para-Cymen-8-ol	6.92	1184	0.09	11.21	1801	0.06
α-Terpineol	7.01	1190	2.95	9.48*	1655	3.03
<i>cis</i> -Piperitol	7.06	1193	0.05	9.23*	1634	0.08
<i>trans</i> -Piperitol	7.25	1206	0.12	10.08*	1704	1.07
endo-Fenchyl acetate	7.35	1212	0.01	6.49	1422	0.01
exo-2-Hydroxycineole	7.48	1221	0.02	11.32	1810	0.02
Nerol	7.60	1229	0.02	10.76*	1762	0.11
Unknown [m/z 137, 152 (28), 43 (25), 91 (24), 109 (23), 119 (19)]	7.68	1234	0.02	11.01	1783	0.01
Piperitone	7.89	1248	0.04	9.55*	1660	0.05
<i>cis</i> -Carvenone oxide?	7.95	1253	0.01			
<i>trans</i> -Ascaridole glycol	8.13	1265	0.05	13.83	2042	0.06
<i>cis</i> -Ascaridole glycol	8.40	1284	0.05	14.44	2102	0.04
Thymol	8.64	1300	0.02	14.70	2128	0.03
Carvacrol	8.72	1305	0.02	15.02	2160	0.02
Unknown [m/z 97, 112 (92), 83 (62), 43 (44), 41 (25)... 170? (4)]	8.89	1314	0.05	14.64	2122	0.06
Bicycloelemene	9.15	1332	0.01	6.74	1440	0.01
α-Cubebene	9.34	1346	0.06	6.47	1420	0.06
Isoledene	9.65	1368	0.06	6.55*	1426	[0.07]
α-Copaene	9.68	1370	0.10	6.83	1447	0.10
7-Cubebene	9.73	1374	0.05	6.80	1445	0.05
7-Cubebene epimer?	9.76	1376	0.02	6.92	1454	0.02
β-Cubebene	9.88	1384	0.02	7.41*	1490	0.04
β-Elemene	9.93	1388	0.02	8.11*†	1545	[0.39]
Unknown [m/z 93, 122 (98), 161 (98),	9.96	1390	0.02			

107 (86), 95 (46), 105 (72)... 204 (34)]						
α-Gurjunene	10.14*	1403	0.34	7.29	1482	0.31
Methyleugenol	10.14*	1403	[0.34]	12.98	1961	0.03
β-Maaliene	10.21	1408	0.02	7.41*	1490	[0.04]
β-Caryophyllene	10.25	1411	0.32	8.09†	1543	0.39
γ-Maaliene	10.37	1420	0.07	8.19	1551	0.07
α-Maaliene	10.45	1426	0.07	8.33*	1562	[42.66]
Aromadendrene	10.52	1431	1.03	8.23	1554	0.94
Selina-5,11-diene	10.58	1436	0.13	8.38	1566	0.13
<i>trans</i> -Muuroala-3,5- diene	10.68	1443	0.10	8.54	1579	0.09
α-Humulene	10.71	1445	0.08	8.94	1610	0.07
allo- Aromadendrene	10.81	1453	0.46	8.66*	1588	[0.60]
Valerena-4,7(11)- diene	10.85	1456	0.04	8.60	1583	0.03
γ-Gurjunene	10.98	1465	0.05	8.80	1599	0.05
<i>trans</i> -Cadina- 1(6),4-diene	11.01	1468	0.28	8.90	1607	0.23
Selina-4,11-diene	11.06*	1471	0.03	9.08	1622	0.03
γ-Muurolole	11.06*	1471	[0.03]	9.23*	1634	[0.08]
Germacrene D	11.09	1474	0.01	9.43	1650	0.03
β-Selinene	11.15	1478	0.09	9.51	1657	0.09
allo-Aromadendr- 9-ene	11.18	1480	0.09	9.20	1631	0.09
<i>trans</i> -Muuroala- 4(15),5-diene	11.22	1483	0.06	9.48*	1655	[3.03]
δ-Selinene	11.25	1485	0.10	9.30*	1640	0.96
α-Selinene	11.29*	1489	1.31	9.59	1663	0.10
Bicyclogermacrene	11.29*	1489	[1.31]	9.71*	1673	0.55
Viridiflorene	11.29*	1489	[1.31]	9.30*	1640	[0.96]
Epizonarene	11.29*	1489	[1.31]	9.55*	1660	[0.05]
α-Muurolole	11.38	1495	0.14	9.71*	1673	[0.55]
γ-Cadinene	11.53	1507	0.04	10.04*	1700	0.25
<i>trans</i> -Calamenene	11.65	1516	0.10	10.87	1772	0.11
δ-Cadinene	11.68*	1519	1.18	10.08*	1704	[1.07]
Zonarene	11.68*	1519	[1.18]	10.04*	1700	[0.25]
<i>trans</i> -Cadina-1,4- diene	11.77	1526	0.16	10.31	1723	0.15
α-Calacorene	11.88	1535	0.02	11.75	1848	0.03
Epiglobulol	12.09	1551	0.06	12.94	1957	0.06
Eudesma-5,7(11)- diene	12.18*	1558	0.09	10.76*	1762	[0.11]
Maaliol	12.18*	1558	[0.09]	12.70	1936	0.03
Unknown [m/z 161, 109 (98), 82 (93), 43 (72), 105 (68), 93 (59), 69 (56), 119 (55)... 222 (7)]	12.18*	1558	[0.09]	12.88	1952	0.01
Palustrol	12.18*	1558	[0.09]	11.91	1863	0.05

Unknown [m/z 107, 163 (88), 59 (60), 93 (49), 43 (47), 81 (46... 204 (5)...]	12.24	1563	0.01	12.85	1949	0.01
Spathulenol	12.31	1568	0.07	14.04	2063	0.07
Globulol	12.39	1575	0.24	13.55	2015	0.23
Gleenol	12.45	1579	0.02	13.23	1984	0.03
Viridiflorol	12.48	1582	0.13	13.63	2023	0.14
Cubeban-11-ol	12.52	1585	0.10	13.33†	1994	[0.16]
Ledol	12.62*	1593	0.09	13.01	1964	0.04
Eudesm-5-en-11-ol analog	12.62*	1593	[0.09]	13.86	2045	0.07
Eudesm-5-en-11-ol	12.71	1600	0.01	13.96*	2055	0.10
10-epi-Cubenol	12.76	1604	0.01	13.37	1998	0.01
Rosifoliol	12.88	1614	0.10	13.96*	2055	[0.10]
1-epi-Cubenol	12.96	1620	0.14	13.41	2001	0.14
Isospathulenol	13.07	1630	0.05	15.08	2166	0.05
Cubenol	13.13	1634	0.08	13.31†	1992	0.16
α-Muurolol	13.18	1639	0.03	14.84	2142	0.04
α-Cadinol	13.27	1646	0.01	15.12	2170	tr
Total identified		99.17%			99.10%	
Total reported		99.30%			99.18%	

*: 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