Date : December 18, 2020

Certificate of Analysis – GC Profiling

Sample identification

Internal code : 20L11-PTH33
Customer identification : Tea Tree - ATTIA - T20111207R
Type : Essential oil
Source : *Melaleuca alternifolia* ct. Terpinen-4-ol
Customer : Plant Therapy

Analysis

Method: PC-MAT-014 ISO - Analysis of the composition of an essential oil or other volatile liquid by FAST GC-FID (in French); identifications validated by GC-MS.
Analyst : Fanny Charlier, B. Sc., chimiste à l'entraînement
Analysis date : December 16, 2020

Checked and approved by :

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

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Méthode certifiée ISO 17025:2017 Certified method

Laboratoire PhytoChemia
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PHYSICOCHEMICAL DATA

Physical aspect: Faintly yellow liquid
Refractive index: 1.4776 ± 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	0.3	Yes
δ-Cadinene	0.2	3.0	1.2	Yes
Viridiflorene	0.1	3.0	0.8	Yes
Aromadendrene	0.2	3.0	0.9	Yes
α-Terpineol	2.0	5.0	3.0	Yes
Terpinen-4-ol	35.0	48.0	39.2	Yes
Terpinolene	1.5	5.0	3.4	Yes
γ-Terpinene	14.0	28.0	20.2	Yes
1,8-Cineole	tr	10.0	2.9	Yes
para-Cymene	0.5	8.0	2.3	Yes
Limonene	0.5	1.5	0.9	Yes
α-Terpinene	6.0	12.0	9.7	Yes
Sabinene	tr	3.5	0.4	Yes
α-Pinene	1.0	4.0	2.5	Yes
Refractive index	1.4750	1.4820	1.4776	Yes

CONCLUSION

No adulterant, contaminant or diluent has been detected using this method. The oil complies with the ISO standard for tea tree oil.

Analysis summary – Consolidated contents

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

Identification	%	Class
Isobutyral	0.03	Aliphatic aldehyde
Isobutanol	tr	Aliphatic alcohol
Isovaleral	tr	Aliphatic aldehyde
2-Methylbutyral	0.02	Aliphatic aldehyde
2-Methylbutanol	tr	Aliphatic alcohol
(3*Z*)-Hexenol	0.05	Aliphatic alcohol
α-Thujene	0.95	Monoterpene
α-Pinene	2.46	Monoterpene
Camphene	0.01	Monoterpene
α-Fenchene	tr	Monoterpene
β-Pinene	0.74	Monoterpene
Sabinene	0.42	Monoterpene
3-Methyl-3-cyclohexenone	0.01	Aliphatic ketone
Myrcene	0.89	Monoterpene
α-Phellandrene	0.45	Monoterpene
Pseudolimonene	0.01	Monoterpene
(3*Z*)-Hexenyl acetate	0.01	Aliphatic ester
α-Terpinene	9.70	Monoterpene
Carvomenthene	0.01	Aliphatic alcohol
para-Cymene	2.26	Monoterpene
Limonene	0.95	Monoterpene
1,8-Cineole	2.93	Monoterpenic ether
β-Phellandrene	0.73	Monoterpene
(*Z*)-β-Ocimene	0.01	Monoterpene
(*E*)-β-Ocimene	0.02	Monoterpene
γ-Terpinene	20.15	Monoterpene
cis-Sabinene hydrate	0.06	Monoterpenic alcohol
para-Cymenene	0.02	Monoterpene
Terpinolene	3.40	Monoterpene
trans-Sabinene hydrate	0.09	Monoterpenic alcohol
Linalool	0.06	Monoterpenic alcohol
Unknown	0.01	Monoterpenic alcohol
para-Mentha-1,3,8-triene	0.01	Monoterpene
endo-Fenchol	0.01	Monoterpenic alcohol
cis-para-Menth-2-en-1-ol	0.32	Monoterpenic alcohol
4-Hydroxy-4-methylcyclohex-2-enone	0.02	Aliphatic alcohol
Cosmene isomer I	0.03	Monoterpene
Camphor	0.06	Monoterpenic ketone
trans-para-Menth-2-en-1-ol	0.18	Monoterpenic alcohol
Unknown	0.01	Oxygenated monoterpene
Unknown	0.04	Unknown
δ-Terpineol	0.01	Monoterpenic alcohol
Terpinen-4-ol	39.21	Monoterpenic alcohol
Dill ether	0.02	Monoterpenic ether
para-Cymen-8-ol	0.04	Monoterpenic alcohol

α-Terpineol	2.96	Monoterpenic alcohol
cis-Piperitol	0.10	Monoterpenic alcohol
trans-Piperitol	0.15	Monoterpenic alcohol
exo-2-Hydroxycineole	0.03	Monoterpenic alcohol
cis-para-Mentha-1(7),8-dien-2-ol	0.02	Monoterpenic alcohol
Nerol	0.01	Monoterpenic alcohol
Unknown	0.01	Oxygenated monoterpene
Piperitone	0.05	Monoterpenic ketone
cis-Carvenone oxide?	0.01	Monoterpenic ketone
trans-Ascaridole glycol	0.06	Monoterpenic alcohol
cis-Ascaridole glycol	0.03	Monoterpenic alcohol
Thymol	0.02	Monoterpenic alcohol
Carvacrol	0.01	Monoterpenic alcohol
Unknown	0.04	Monoterpenic alcohol
Bicycloelemene	0.01	Sesquiterpene
α-Cubebene	0.05	Sesquiterpene
Isoledene	0.07	Sesquiterpene
α-Copaene	0.10	Sesquiterpene
7-Cubebene epimer?	0.02	Aliphatic alcohol
β-Elemene	0.04	Sesquiterpene
α-Gurjunene	0.34	Sesquiterpene
Methyleugenol	0.03	Phenylpropanoid
β-Maaliene	0.02	Sesquiterpene
β-Caryophyllene	0.37	Sesquiterpene
β-Ylangene	0.01	Sesquiterpene
γ-Maaliene	0.06	Sesquiterpene
β-Gurjunene	0.02	Sesquiterpene
α-Maaliene	0.06	Sesquiterpene
Aromadendrene	0.88	Sesquiterpene
Selina-5,11-diene	0.13	Sesquiterpene
Unknown	0.13	Unknown
trans-Muurola-3,5-diene	0.11	Sesquiterpene
α-Humulene	0.11	Sesquiterpene
allo-Aromadendrene	0.47	Sesquiterpene
Valerena-4,7(11)-diene	0.04	Sesquiterpene
γ-Gurjunene	0.05	Sesquiterpene
trans-Cadina-1(6),4-diene	0.29	Sesquiterpene
Selina-4,11-diene	0.03	Sesquiterpene
γ-Muurolene	0.01	Sesquiterpene
(1S,2S,4S)-para-Menthane-1,2,4-triol	0.10	Monoterpenic alcohol
β-Selinene	0.09	Sesquiterpene
allo-Aromadendr-9-ene	0.08	Sesquiterpene
δ-Selinene	0.11	Sesquiterpene
α-Selinene	0.09	Sesquiterpene
Bicyclogermacrene	0.83	Sesquiterpene
Viridiflorene	0.82	Sesquiterpene
α-Muurolene	0.17	Sesquiterpene
γ-Cadinene	0.03	Sesquiterpene
Zonarene	0.07	Sesquiterpene
δ-Cadinene	1.19	Sesquiterpene
trans-Calamenene	0.10	Sesquiterpene
trans-Cadina-1,4-diene	0.17	Sesquiterpene

α-Calacorene	0.01	Sesquiterpene
Eudesma-5,7(11)-diene	0.03	Sesquiterpene
Palustrol	0.05	Sesquiterpenic alcohol
Spathulenol	0.07	Sesquiterpenic alcohol
Globulol	0.27	Sesquiterpenic alcohol
Gleenol	0.04	Sesquiterpenic alcohol
Viridiflorol	0.13	Sesquiterpenic alcohol
Cubeban-11-ol	0.13	Sesquiterpenic alcohol
Ledol	0.04	Sesquiterpenic alcohol
Eudesm-5-en-11-ol analog	0.07	Sesquiterpenic alcohol
10-epi-Cubenol	0.01	Sesquiterpenic alcohol
Rosifoliol	0.11	Sesquiterpenic alcohol
1-epi-Cubenol	0.16	Sesquiterpenic alcohol
Isospathulenol	0.05	Sesquiterpenic alcohol
Cubenol	0.10	Sesquiterpenic alcohol
α-Muurolol	0.03	Sesquiterpenic alcohol
α-Cadinol	0.01	Sesquiterpenic alcohol
Consolidated total	**98.57%**	

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.

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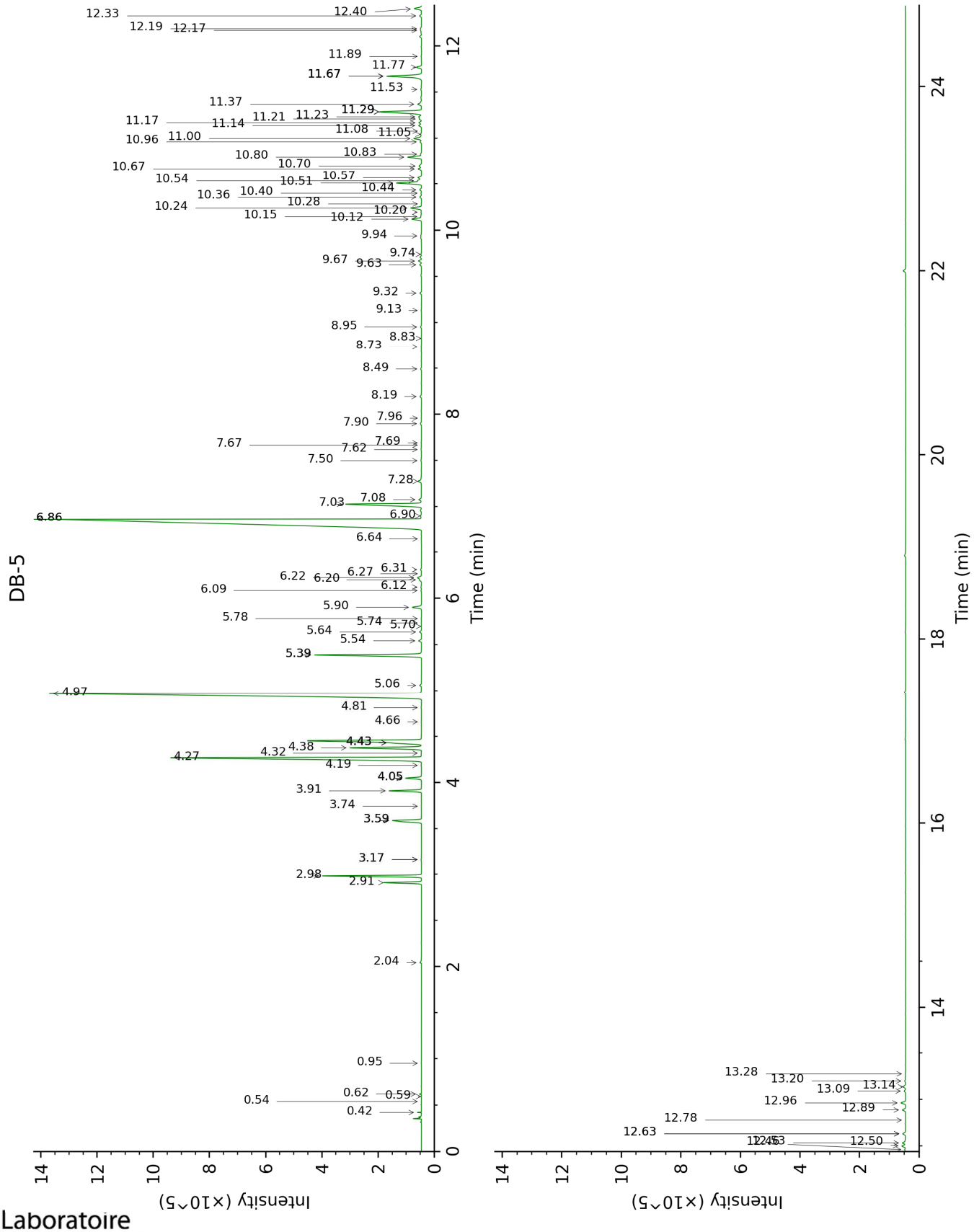
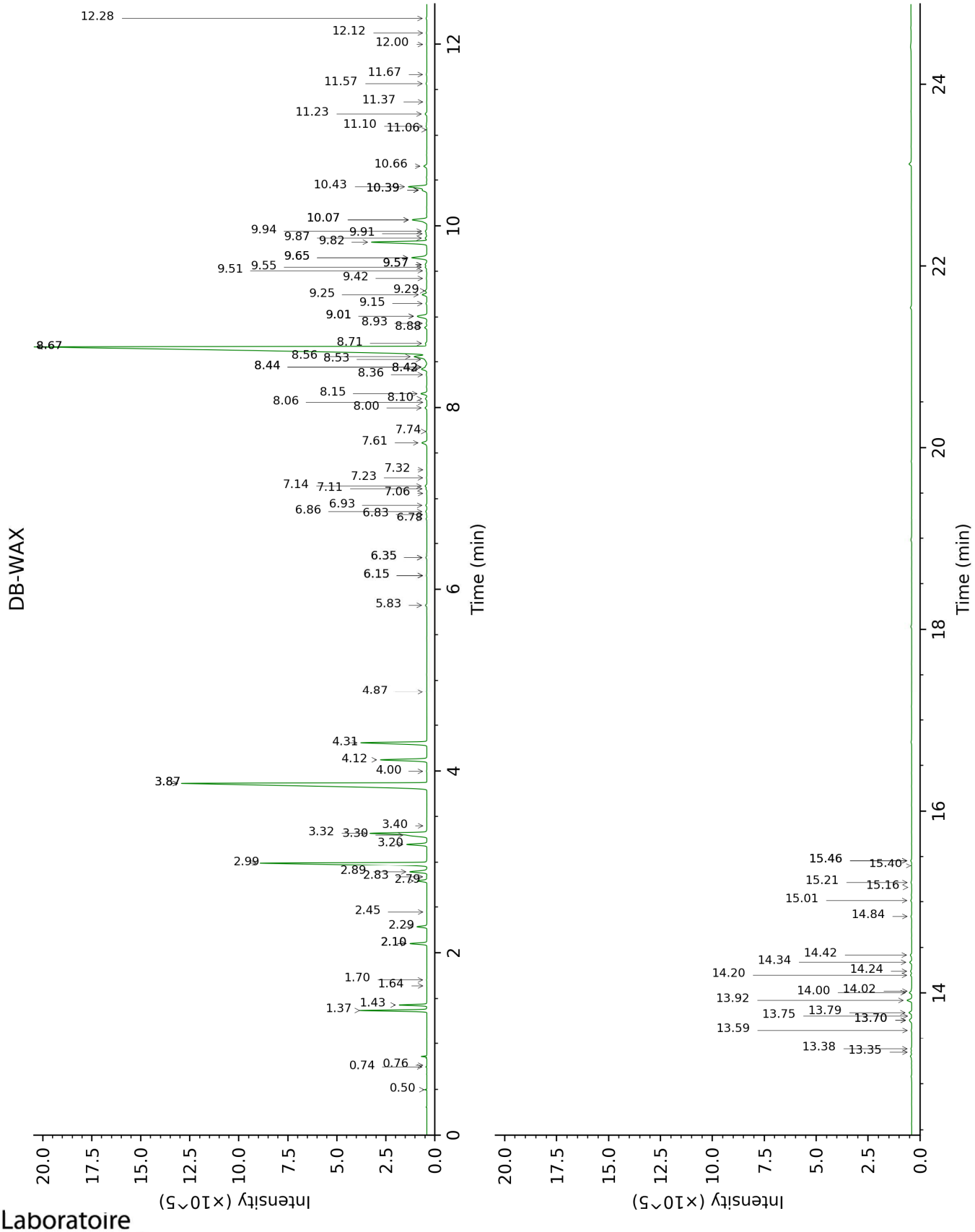

DB-5
Time (min)
Intensity (×10^5)
12.33
12.40
12.19
12.17
11.89
11.77
11.67
11.53
11.37
11.29
11.17
11.14
11.21
11.23
11.08
11.05
10.96
11.00
10.80
10.83
10.67
10.70
10.54
10.51
10.57
10.44
10.36
10.40
10.28
10.24
10.20
10.15
10.12
9.94
9.74
9.67
9.63
9.32
9.13
8.95
8.83
8.73
8.49
8.19
7.90
7.96
7.67
7.69
7.62
7.50
7.28
7.03
7.08
6.90
6.86
6.64
6.22
6.20
6.27
6.31
6.12
6.09
5.90
5.78
5.74
5.70
5.64
5.54
5.39
5.06
4.97
4.81
4.66
4.43
4.38
4.32
4.27
4.19
4.05
3.91
3.74
3.59
3.17
2.98
2.91
2.04
0.95
0.62
0.59
0.54
0.42
13.28
13.20
13.09
13.14
12.96
12.89
12.78
12.63
12.50


DB-WAX
Time (min)
Intensity (×10^5)
12.28
12.12
12.00
11.67
11.57
11.37
11.23
11.10
11.06
10.66
10.43
10.39
10.07
9.94
9.91
9.87
9.82
9.65
9.57
9.55
9.51
9.42
9.29
9.25
9.15
9.01
8.93
8.88
8.71
8.67
8.56
8.53
8.44
8.42
8.36
8.15
8.10
8.06
8.00
7.74
7.61
7.32
7.23
7.14
7.11
7.06
6.93
6.86
6.83
6.78
6.35
6.15
5.83
4.87
4.31
4.12
4.00
3.87
3.40
3.32
3.30
3.20
2.99
2.89
2.83
2.79
2.45
2.29
2.10
1.70
1.64
1.43
1.37
0.76
0.74
0.50
15.46
15.40
15.21
15.16
15.01
14.84
14.42
14.34
14.24
14.20
14.02
14.00
13.92
13.79
13.75
13.70
13.59
13.38
13.35

FULL ANALYSIS DATA

Identification	Column DB-5			Column DB-WAX		
	R.T	R.I	%	R.T	R.I	%
Isobutyral	0.42	539	0.03	0.50	783	0.04
Isobutanol	0.54	613	tr	2.10*	1067	0.74
Isovaleral	0.59	638	tr	0.76	889	tr
2-Methylbutyral	0.62	650	0.02	0.74	882	0.02
2-Methylbutanol	0.95	739	tr	3.40	1175	0.01
(3*Z*)-Hexenol	2.04	859	0.05	5.83	1351	0.07
α-Thujene	2.91	926	0.95	1.43	1000	0.95
α-Pinene	2.98	931	2.46	1.37	992	2.45
Camphene	3.17*	943	0.02	1.70	1027	0.01
α-Fenchene	3.17*	943	[0.02]	1.64	1020	tr
β-Pinene	3.59*	971	1.16	2.10*	1067	[0.74]
Sabinene	3.59*	971	[1.16]	2.29	1085	0.42
3-Methyl-3-cyclohexenone	3.74	981	0.01	6.15*	1374	0.02
Myrcene	3.91	992	0.89	2.89	1135	0.89
α-Phellandrene	4.05*	1001	0.47	2.79	1127	0.45
Pseudolimonene	4.05*	1001	[0.47]	2.83	1130	0.01
(3*Z*)-Hexenyl acetate	4.19	1010	0.01	4.87	1286	0.02
α-Terpinene	4.27	1015	9.70	2.99	1143	9.70
Carvomenthene	4.32	1018	0.01	2.45	1100	tr
para-Cymene	4.38	1022	2.26	4.12	1230	2.26
Limonene	4.43*†	1025	4.67	3.20	1159	0.95
1,8-Cineole	4.43*†	1025	[4.67]	3.32	1169	2.93
β-Phellandrene	4.43*†	1025	[4.67]	3.30	1167	0.73
(*Z*)-β-Ocimene	4.66	1039	0.01	3.87*	1211	20.14
(*E*)-β-Ocimene	4.81	1049	0.02	4.00	1221	0.02
γ-Terpinene	4.97	1059	20.15	3.87*	1211	[20.14]
cis-Sabinene hydrate	5.06	1064	0.06	6.93	1431	0.06
para-Cymenene	5.39*	1085	3.43	6.35*	1388	0.05
Terpinolene	5.39*	1085	[3.43]	4.31	1244	3.40
trans-Sabinene hydrate	5.54	1095	0.09	8.00	1511	0.09
Linalool	5.64	1101	0.06	8.10	1519	0.08
Unknown [m/z 119, 109 (94), 43 (61), 95 (56), 91 (48), 77 (32), 152 (32), 137 (31), 134 (24)]	5.70	1105	0.01	8.44*	1546	0.08
para-Mentha-1,3,8-triene	5.74	1107	0.01	6.15*	1374	[0.02]
endo-Fenchol	5.78	1110	0.01	8.42*	1544	0.36
cis-para-Menth-2-en-1-ol	5.90	1118	0.32	8.15	1523	0.32

4-Hydroxy-4-methylcyclohex-2-enone	6.09	1130	0.02	14.02	2025	0.03
Cosmene isomer I	6.12	1132	0.03	6.35*	1388	[0.05]
Camphor	6.20	1137	0.06	7.11	1445	0.05
trans-para-Menth-2-en-1-ol	6.22	1138	0.18	9.01*	1590	0.69
Unknown [m/z 109, 43 (73), 71 (54), 124 (51), 69 (37), 41 (35)...152 (5)]	6.27	1141	0.01			
Unknown [m/z 109, 124 (45), 119 (41), 43 (35), 91 (28), 95 (25)...]	6.31	1144	0.04	6.83	1424	0.02
δ-Terpineol	6.64	1166	0.01	9.51	1630	0.03
Terpinen-4-ol	6.86*	1180	39.47	8.67*	1563	39.27
Dill ether	6.86*	1180	[39.47]	7.23	1454	0.02
para-Cymen-8-ol	6.90	1182	0.04	11.57	1801	0.05
α-Terpineol	7.03	1190	2.96	9.82	1655	3.06
cis-Piperitol	7.08	1194	0.10	9.55	1633	0.10
trans-Piperitol	7.28	1206	0.15	10.39*	1702	0.25
exo-2-Hydroxycineole	7.50	1222	0.03	11.67	1810	0.03
cis-para-Mentha-1(7),8-dien-2-ol	7.62	1230	0.02	12.00	1839	0.02
Nerol	7.67	1233	0.01	11.06	1758	0.01
Unknown [m/z 137, 152 (28), 43 (25), 91 (24), 109 (23), 119 (19)]	7.69	1235	0.01	11.37	1784	0.01
Piperitone	7.90	1249	0.05	9.91	1662	0.05
cis-Carvenone oxide?	7.96	1253	0.01			
trans-Ascaridole glycol	8.19	1269	0.06	14.20	2042	0.06
cis-Ascaridole glycol	8.49	1289	0.03	14.84	2104	0.05
Thymol	8.74	1301	0.02	15.16	2136	0.01
Carvacrol	8.83	1308	0.01	15.40	2160	0.01
Unknown [m/z 97, 112 (92), 83 (62), 43 (44), 41 (25)... 170? (4)]	8.95	1317	0.04	15.01	2121	0.05
Bicycloelemene	9.13	1330	0.01	7.06	1441	0.02
α-Cubebene	9.32	1343	0.05	6.78	1420	0.06
Isoledene	9.63	1365	0.07	6.86	1426	0.06
α-Copaene	9.67	1368	0.10	7.14	1447	0.10
7-Cubebene epimer?	9.74	1373	0.02	7.32	1460	0.01
β-Elemene	9.94	1388	0.04	8.44*	1546	[0.08]

α-Gurjunene	10.12	1401	0.34	7.61	1482	0.32
Methyleugenol	10.15	1403	0.03	13.34	1961	0.03
β-Maaliene	10.20	1406	0.02	7.74	1491	0.04
β-Caryophyllene	10.24	1410	0.37	8.42*	1544	[0.36]
β-Ylangene	10.28	1413	0.01	8.06	1516	0.01
γ-Maaliene	10.36	1418	0.06	8.53	1552	0.09
β-Gurjunene	10.40	1422	0.02	8.36	1539	0.03
α-Maaliene	10.44	1424	0.06	8.67*	1563	[39.27]
Aromadendrene	10.51	1430	0.88	8.56	1555	0.88
Selina-5,11-diene	10.54	1432	0.13	8.71	1566	0.10
Unknown [m/z 43, 71 (71), 95 (40), 79 (34), 93 (33), 41 (29)...]	10.57	1434	0.13			
trans-Muurola-3,5-diene	10.67	1442	0.11	8.88	1580	0.11
α-Humulene	10.70	1444	0.11	9.29	1612	0.10
allo-Aromadendrene	10.80	1452	0.47	9.01*	1590	[0.69]
Valerena-4,7(11)-diene	10.83	1454	0.04	8.93	1584	0.04
γ-Gurjunene	10.96	1464	0.05	9.15	1601	0.05
trans-Cadina-1(6),4-diene	11.00	1467	0.29	9.25	1608	0.26
Selina-4,11-diene	11.05	1470	0.03	9.42	1623	0.04
γ-Muurolene	11.08	1473	0.01	9.58*	1635	0.11
(1S,2S,4S)-para-Menthane-1,2,4-triol	11.14	1477	0.10			
β-Selinene	11.17	1480	0.09	9.87	1659	0.09
allo-Aromadendr-9-ene	11.21	1483	0.08	9.58*	1635	[0.11]
δ-Selinene	11.23	1484	0.11	9.65*	1641	0.93
α-Selinene	11.29*	1488	1.75	9.94	1665	0.09
Bicyclogermacrene	11.29*	1488	[1.75]	10.07*	1675	1.00
Viridiflorene	11.29*	1488	[1.75]	9.65*	1641	[0.93]
α-Muurolene	11.37	1495	0.17	10.07*	1675	[1.00]
γ-Cadinene	11.53	1507	0.03	10.39*	1702	[0.25]
Zonarene	11.67*	1518	1.38	10.39*	1702	[0.25]
δ-Cadinene	11.67*	1518	[1.38]	10.43	1705	1.19
trans-Calamenene	11.67*	1518	[1.38]	11.23	1773	0.10
trans-Cadina-1,4-diene	11.77	1526	0.17	10.66	1724	0.19
α-Calacorene	11.89	1535	0.01	12.12	1850	0.02
Eudesma-5,7(11)-diene	12.17	1557	0.03	11.10	1761	0.04
Palustrol	12.19	1559	0.05	12.28	1864	0.04
Spathulenol	12.33	1570	0.07	14.42	2063	0.08
Globulol	12.40	1576	0.27	13.92	2015	0.26
Gleenol	12.46	1580	0.04	13.59	1984	0.03
Viridiflorol	12.50	1584	0.13	14.00	2023	0.13
Cubeban-11-ol	12.53	1586	0.13	13.70*	1994	0.18

Ledol	12.63*	1594	0.11	13.38	1965	0.04
Eudesm-5-en-11-ol analog	12.63*	1594	[0.11]	14.24	2046	0.07
10-epi-Cubenol	12.78	1606	0.01	13.75	1998	0.01
Rosifoliol	12.89	1615	0.11	14.34	2055	0.11
1-epi-Cubenol	12.96	1621	0.16	13.78	2002	0.16
Isospathulenol	13.09	1631	0.05	15.46*	2166	0.05
Cubenol	13.14	1635	0.10	13.70*	1994	[0.18]
α-Muurolol	13.20	1640	0.03	15.21	2141	0.05
α-Cadinol	13.28	1647	0.01	15.46*	2166	[0.05]
Total identified		**98.64%**			**98.36%**	
Total reported		**98.88%**			**98.45%**	

*: 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