Date : March 30, 2020

Certificate of Analysis – GC Profiling

Sample identification

Internal code : 20C27-PTH12
Customer identification : Thyme Thymol - Spain - T40108201R
Type : Essential oil
Source : *Thymus vulgaris* ct. Thymol
Customer : Plant Therapy

Analysis

Method: PC-MAT-007 - Analysis of the composition of an essential oil or other volatile liquide by FAST GC-FID (in French); identifications validated by GC-MS.
Analyst : Sylvain Mercier, M. Sc., Chimiste
Analysis date : March 30, 2020

Checked and approved by :

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

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PHYSICOCHEMICAL DATA

Physical aspect: Light brown liquid
Refractive index: 1.5031 ± 0.0003 (20 °C)

ISO 19817:2017 - ESSENTIAL OIL OF THYME, THYMOL TYPE

Compound	Min. %	Max. %	Observed %	Complies?
β-Caryophyllene	0.5	4.0	1.3	Yes
Carvacrol	0.5	5.5	4.2	Yes
Thymol	35.0	55.0	51.5	Yes
Carvacrol methyl ether	0.1	1.5	0.3	Yes
Terpinen-4-ol	0.1	2.5	1.0	Yes
Linalool	0.5	6.5	3.7	Yes
cis-Sabinene hydrate	tr	0.50	0.22	Yes
para-Cymene	14.0	28.0	18.5	Yes
γ-Terpinene	4.0	13.0	7.2	Yes
α-Terpinene	0.9	2.6	1.0	Yes
Myrcene	1.0	2.8	1.4	Yes
α-Pinene	0.5	2.5	0.8	Yes
α-Thujene	0.5	1.5	0.6	Yes
Refractive index	1.4940	1.5040	1.5031	Yes

CONCLUSION

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

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Analysis summary – Consolidated contents

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

Identification	%	Classe
Isobutyral	tr	Aliphatic aldehyde
2-Methyl-3-buten-2-ol	tr	Aliphatic alcohol
Isovaleral	0.01	Aliphatic aldehyde
2-Methylbutyral	0.01	Aliphatic aldehyde
2-Ethylfuran	tr	Furan
2-Methylbutanol	tr	Aliphatic alcohol
Methyl 2-methylbutyrate	0.01	Aliphatic ester
Octane	tr	Alkane
Unknown	tr	Unknown
(3*Z*)-Hexenol	tr	Aliphatic alcohol
Hexanol	0.01	Aliphatic alcohol
Heptan-3-one	0.01	Aliphatic ketone
Hashishene	0.01	Monoterpene
Tricyclene	0.04	Monoterpene
α-Thujene	0.58	Monoterpene
α-Pinene	0.79	Monoterpene
Camphene	0.69	Monoterpene
α-Fenchene	0.01	Monoterpene
Unknown	0.01	Monoterpene
Thuja-2,4(10)-diene	0.01	Monoterpene
β-Pinene	0.46	Monoterpene
Sabinene	tr	Monoterpene
Heptanol	0.01	Aliphatic alcohol
Unknown	0.01	Monoterpene
Octen-3-ol	0.06	Aliphatic alcohol
Octan-3-one	0.10	Aliphatic ketone
Myrcene	1.39	Monoterpene
Octan-3-ol	0.03	Aliphatic alcohol
α-Phellandrene	0.12	Monoterpene
Pseudolimonene	0.01	Monoterpene
Δ3-Carene	0.08	Monoterpene
α-Terpinene	1.04	Monoterpene
para-Cymene	18.47	Monoterpene
Limonene	0.35	Monoterpene
β-Phellandrene	0.25	Monoterpene
1,8-Cineole	0.03	Monoterpenic ether
(*Z*)-β-Ocimene	0.01	Monoterpene
(*E*)-β-Ocimene	0.03	Monoterpene
γ-Terpinene	7.23	Monoterpene
2-Methylbutyl butyrate	0.01	Aliphatic ester
cis-Sabinene hydrate	0.22	Monoterpenic alcohol
3-Methyl-3-butenyl butyrate?	0.03	Aliphatic ester
cis-Linalool oxide (fur.)	0.03	Monoterpenic alcohol
Octanol	0.01	Aliphatic alcohol
Terpinolene	0.10	Monoterpene
trans-Linalool oxide (fur.)	0.04	Monoterpenic alcohol
para-Cymenene	0.07	Monoterpene

Unknown	0.01	Unknown
trans-Sabinene hydrate	0.12	Monoterpenic alcohol
Linalool	3.70	Monoterpenic alcohol
Hotrienol	0.02	Monoterpenic alcohol
Nonanal	0.01	Aliphatic aldehyde
endo-Fenchol	0.03	Monoterpenic alcohol
cis-para-Menth-2-en-1-ol	0.06	Monoterpenic alcohol
Unknown	0.01	Unknown
trans-Pinocarveol	0.03	Monoterpenic alcohol
Camphor	0.52	Monoterpenic ketone
trans-para-Menth-2-en-1-ol	0.02	Monoterpenic alcohol
trans-Chrysanthemal	0.06	Monoterpenic aldehyde
Unknown	0.02	Oxygenated monoterpene
Isoborneol	0.02	Monoterpenic alcohol
Borneol	0.93	Monoterpenic alcohol
Terpinen-4-ol	1.00	Monoterpenic alcohol
α-Terpineol	0.08	Monoterpenic alcohol
cis-Dihydrocarvone	0.10	Monoterpenic ketone
trans-Dihydrocarvone	0.06	Monoterpenic ketone
Bornyl formate	0.05	Monoterpenic ester
Thymol methyl ether analog I	0.02	Monoterpenic ether
Neral	0.04	Monoterpenic aldehyde
Carvacrol methyl ether	0.33	Monoterpenic ether
Geraniol	0.01	Monoterpenic alcohol
Geranial	0.06	Monoterpenic aldehyde
Thymol analogue I	0.14	Monoterpenic alcohol
Thymol	51.48	Monoterpenic alcohol
Carvacrol	4.20	Monoterpenic alcohol
Thymyl acetate	0.02	Monoterpenic ester
α-Copaene	0.02	Sesquiterpene
β-Bourbonene	0.01	Sesquiterpene
Geranyl acetate	0.01	Monoterpenic ester
Unknown	0.07	Unknown
β-Caryophyllene	1.28	Sesquiterpene
Aromadendrene	0.09	Sesquiterpene
α-Humulene	0.45*	Sesquiterpene
Unknown	[0.45]*	Oxygenated monoterpene
Unknown	0.04	Unknown
allo-Aromadendrene	0.04	Sesquiterpene
(*E*)-β-Farnesene	0.02	Sesquiterpene
Thymohydroquinone isomer?	0.07	Simple phenolic
γ-Muurolene	0.03	Sesquiterpene
Germacrene D	0.01	Sesquiterpene
β-Selinene	0.01	Sesquiterpene
allo-Aromadendr-9-ene	0.01	Sesquiterpene
Viridiflorene	0.05	Sesquiterpene
α-Muurolene	0.03	Sesquiterpene
γ-Cadinene	0.04	Sesquiterpene
β-Bisabolene	0.01	Sesquiterpene
Cubebol	0.01	Sesquiterpenic alcohol
δ-Cadinene	0.10	Sesquiterpene
trans-Cadina-1,4-diene	0.03	Sesquiterpene

α-Cadinene	0.01	Sesquiterpene
Geranyl butyrate	0.05	Monoterpenic ester
Spathulenol	0.07	Sesquiterpenic alcohol
Caryophyllene oxide	0.20	Sesquiterpenic ether
Caryophyllene oxide isomer	0.02	Sesquiterpenic ether
Unknown	0.02	Oxygenated sesquiterpene
Humulene epoxide II	0.01	Sesquiterpenic ether
Geranyl isovalerate	0.01	Monoterpenic ester
10-epi-γ-Eudesmol	0.02	Sesquiterpenic alcohol
1-epi-Cubenol	0.01	Sesquiterpenic alcohol
10,10-Dimethyl-2,6-dimethylenebicyclo[7.2.0]undecan-5β-ol?	0.02	Sesquiterpenic alcohol
τ-Cadinol	0.03	Sesquiterpenic alcohol
α-Cadinol	0.03	Sesquiterpenic alcohol
(3*Z*)-Caryophylla-3,8(13)-dien-5β-ol	0.03	Sesquiterpenic alcohol
Shyobunol	0.01	Sesquiterpenic alcohol
Unknown	0.02	Unknown
Unknown	0.05	Unknown
Unknown	0.10	Unknown
Unknown	0.01	Unknown
Unknown	0.03	Unknown
Unknown	0.01	Unknown
Unknown	0.01	Unknown
Unknown	0.01	Unknown
Unknown	0.01	Unknown
Unknown	0.01	Unknown
Unknown	0.01	Unknown
Consolidated total	**98.82%**	

*: Individual compounds concentration could not be found due to overlapping coelutions on columns considered
[xx]: Duplicate percentage due to coelutions, not taken into account in the consolidated total
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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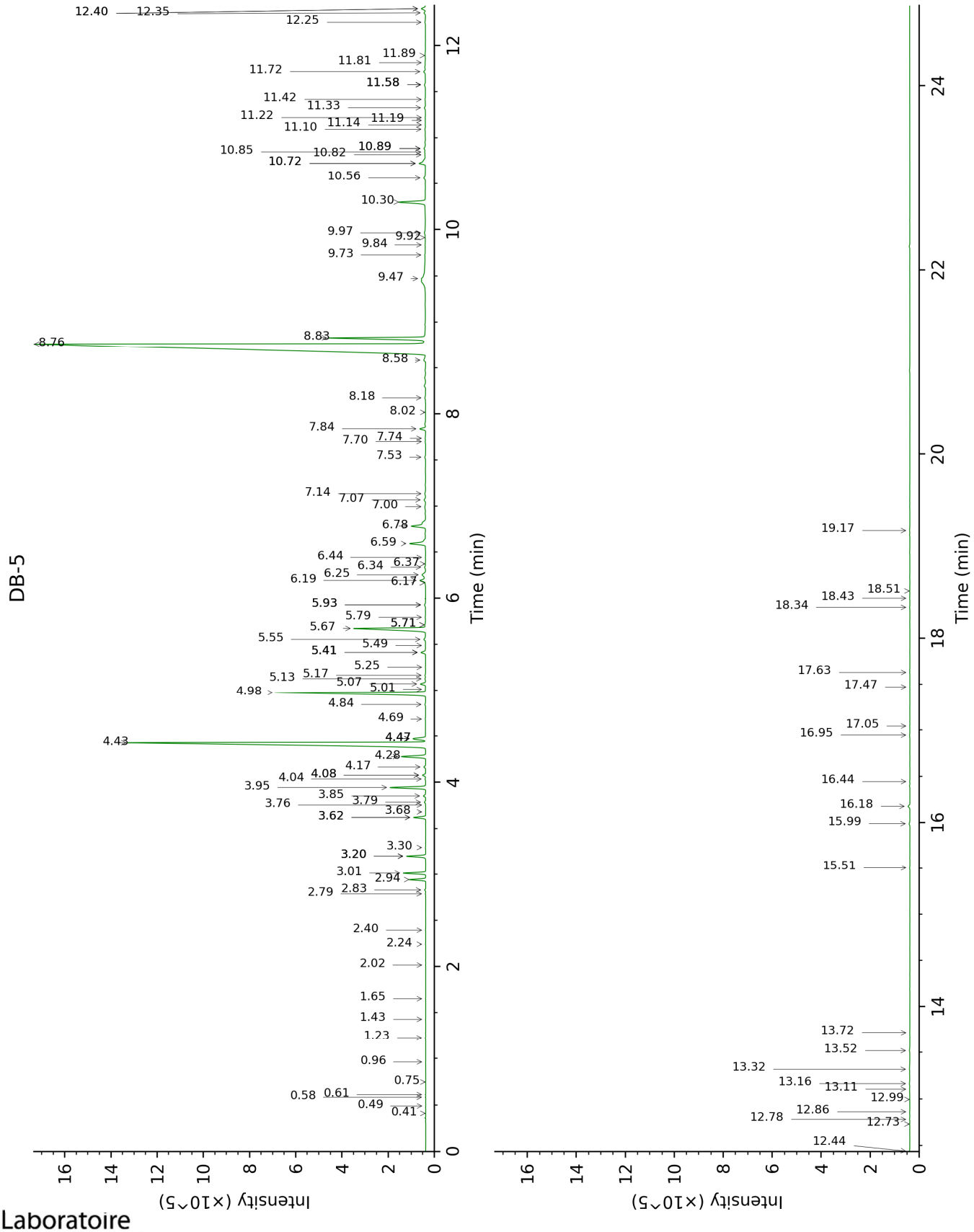
DB-5
Time (min)
Intensity (×10^5)
12.40
12.35
12.25
11.81
11.89
11.72
11.58
11.42
11.33
11.22
11.10
11.14
11.19
10.85
10.82
10.89
10.72
10.56
10.30
9.97
9.92
9.84
9.73
9.47
8.83
8.76
8.58
8.18
8.02
7.84
7.70
7.74
7.53
7.14
7.07
7.00
6.78
6.59
6.44
6.34
6.37
6.19
6.25
6.17
5.93
5.79
5.67
5.71
5.55
5.49
5.41
5.25
5.13
5.17
5.07
5.01
4.98
4.84
4.69
4.47
4.43
4.28
4.17
4.04
4.08
3.95
3.85
3.79
3.76
3.68
3.62
3.30
3.20
3.01
2.94
2.79
2.83
2.40
2.24
2.02
1.65
1.43
1.23
0.96
0.75
0.58
0.61
0.49
0.41
19.17
18.51
18.43
18.34
17.63
17.47
17.05
16.95
16.44
16.18
15.99
15.51
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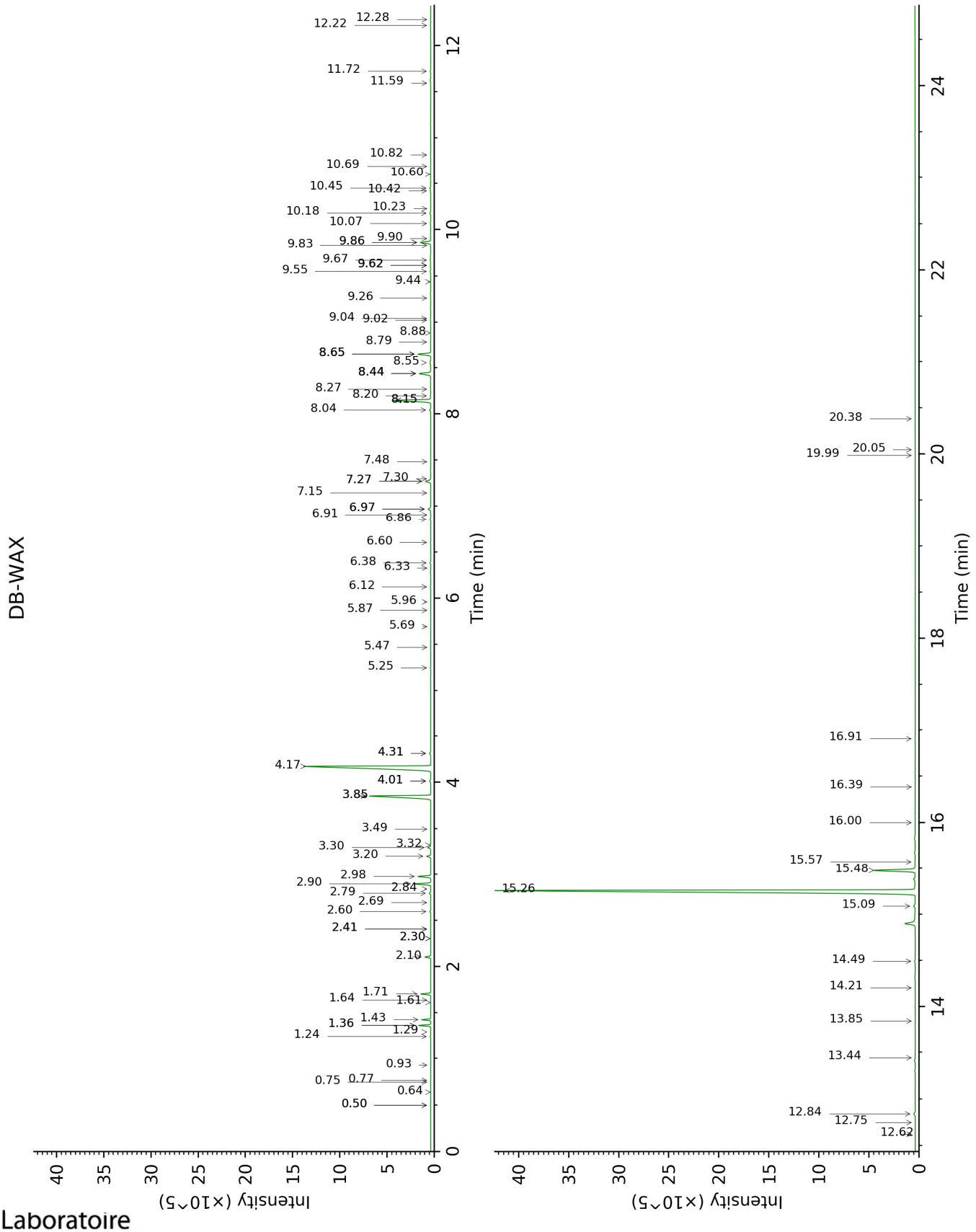
13.32
13.16
13.11
12.99
12.86
12.78
12.73
12.44


DB-WAX
Time (min)
Intensity (×10^5)
12.22
12.28
11.72
11.59
10.82
10.69
10.60
10.45
10.42
10.18
10.23
10.07
9.83
9.86
9.90
9.67
9.62
9.55
9.44
9.26
9.04
9.02
8.88
8.79
8.65
8.55
8.44
8.27
8.20
8.15
8.04
7.48
7.27
7.30
7.15
6.91
6.97
6.86
6.60
6.38
6.33
6.12
5.96
5.87
5.69
5.47
5.25
4.31
4.17
4.01
3.85
3.49
3.30
3.32
3.20
2.98
2.90
2.79
2.84
2.69
2.60
2.41
2.30
2.10
1.64
1.71
1.61
1.43
1.36
1.24
1.29
0.93
0.75
0.77
0.64
0.50
20.38
19.99
20.05
16.91
16.39
16.00
15.57
15.48
15.26
15.09
14.49
14.21
13.85
13.44
12.84
12.75
12.62

FULL ANALYSIS DATA

Identification	Column DB-5			Column DB-WAX		
	R.T	R.I	%	R.T	R.I	%
Isobutyral	0.41	529	tr	0.50*	786	0.01
2-Methyl-3-buten-2-ol	0.49	587	tr	1.61	1018	tr
Isovaleral	0.58	639	0.01	0.77	891	0.01
2-Methylbutyral	0.61	651	0.01	0.75	884	0.01
2-Ethylfuran	0.75	707	tr	0.93	920	tr
2-Methylbutanol	0.96	740	tr	3.49	1180	tr
Methyl 2-methylbutyrate	1.23	777	0.01	1.29	980	0.01
Octane	1.43	805	tr	0.50*	786	[0.01]
Unknown [m/z 81, 69 (80), 41 (65), 83 (52), 109 (48), 55 (47)...]	1.65	824	tr	0.64	844	tr
(3*Z*)-Hexenol	2.02	854	tr	5.87	1351	0.01
Hexanol	2.24	873	0.01	5.47	1322	0.01
Heptan-3-one	2.40	885	0.01	2.69	1118	0.01
Hashishene	2.79	915	0.01	1.36*	992	0.80
Tricyclene	2.83	918	0.04	1.24	972	0.04
α-Thujene	2.94	925	0.58	1.43	999	0.57
α-Pinene	3.01	930	0.79	1.36*	992	[0.80]
Camphene	3.20*	942	0.73	1.70	1027	0.69
α-Fenchene	3.20*	942	[0.73]	1.64	1020	0.01
Unknown [m/z 91, 92 (47), 65 (11)... 134 (1)]	3.20*	942	[0.73]	2.41*	1096	0.02
Thuja-2,4(10)-diene	3.30	948	0.01	2.30*	1086	0.02
β-Pinene	3.62*	970	0.46	2.10	1066	0.46
Sabinene	3.62*	970	[0.46]	2.30*	1086	[0.02]
Heptanol	3.68	974	0.01	6.91	1426	0.01
Unknown [m/z 93, 79 (73), 67 (49), 95 (42), 91 (41), 121 (38)...]	3.76	979	0.01	2.41*	1096	[0.02]
Octen-3-ol	3.79	981	0.06	6.86	1422	0.07
Octan-3-one	3.85	986	0.10	4.01*	1218	0.13
Myrcene	3.95	992	1.39	2.90	1133	1.38
Octan-3-ol	4.04	998	0.03	6.12	1369	0.04
α-Phellandrene	4.08*	1000	0.14	2.79	1125	0.12
Pseudolimonene	4.08*	1000	[0.14]	2.84	1129	0.01
Δ3-Carene	4.17	1006	0.08	2.60	1110	0.07
α-Terpinene	4.28	1013	1.04	2.98	1140	1.04
para-Cymene	4.43	1023	18.47	4.17	1229	18.43
Limonene	4.47*	1025	0.63	3.20	1157	0.35
β-Phellandrene	4.47*	1025	[0.63]	3.30	1164	0.25
1,8-Cineole	4.47*	1025	[0.63]	3.32	1166	0.03
(*Z*)-β-Ocimene	4.69	1039	0.01	3.85*	1206	7.20
(*E*)-β-Ocimene	4.84	1049	0.03	4.01*	1218	[0.13]
γ-Terpinene	4.98	1057	7.23	3.85*	1206	[7.20]
2-Methylbutyl butyrate	5.01	1060	0.01	4.31*	1239	0.11
cis-Sabinene hydrate	5.07	1063	0.22	6.97*	1431	0.26
3-Methyl-3-butenyl butyrate?	5.13	1067	0.03	5.25	1306	0.03
cis-Linalool oxide (fur.)	5.17	1069	0.03	6.60	1404	0.03
Octanol	5.25	1075	0.01	8.27	1528	0.02
Terpinolene	5.41*	1085	0.22	4.31*	1239	[0.11]

trans-Linalool oxide (fur.)	5.41*	1085	[0.22]	6.97*	1431	[0.26]
para-Cymenene	5.41*	1085	[0.22]	6.38	1387	0.07
Unknown [m/z 123, 81 (78), 79 (39), 41 (31), 67 (28), 150 (27)...]	5.49	1090	0.01	5.69	1338	0.01
trans-Sabinene hydrate	5.56	1094	0.12	8.04	1511	0.13
Linalool	5.67†	1102	3.76	8.15*	1519	3.74
Hotrienol	5.71*†	1104	[3.76]	8.88	1575	0.02
Nonanal	5.71*†	1104	[3.76]	5.96	1357	0.01
endo-Fenchol	5.79	1109	0.03	8.44*	1541	1.29
cis-para-Menth-2-en-1-ol	5.93*	1118	0.07	8.20	1522	0.06
Unknown [m/z 81, 79 (19), 41 (12), 92 (8), 77 (8)...]	5.93*	1118	[0.07]	6.33	1383	0.01
trans-Pinocarveol	6.17	1134	0.03	9.26	1605	0.02
Camphor	6.19†	1135	0.60	7.27*	1453	0.58
trans-para-Menth-2-en-1-ol	6.25†	1139	[0.60]	9.02	1586	0.02
trans-Chrysanthemal	6.34	1145	0.06	7.27*	1453	[0.58]
Unknown [m/z 123, 81 (60), 67 (49), 95 (36), 41 (29), 68 (25)...152 (2)]	6.37	1147	0.02	7.30	1455	0.02
Isoborneol	6.44	1152	0.02	9.44	1619	0.01
Borneol	6.59	1161	0.93	9.86*	1654	1.04
Terpinen-4-ol	6.78	1174	1.00	8.65*	1557	1.25
α-Terpineol	7.00	1188	0.08	9.86*	1654	[1.04]
cis-Dihydrocarvone	7.07	1193	0.10	8.56	1550	0.15
trans-Dihydrocarvone	7.14	1197	0.06	8.79	1568	0.03
Bornyl formate	7.53	1224	0.05	8.15*	1519	[3.74]
Thymol methyl ether analog I	7.70	1236	0.02	8.44*	1541	[1.29]
Neral	7.74	1238	0.04	9.55	1628	0.07
Carvacrol methyl ether	7.84	1246	0.33	8.65*	1557	[1.25]
Geraniol	8.02	1258	0.01	11.72	1809	0.05
Geranial	8.18	1269	0.06	10.18	1679	0.08
Thymol analogue I	8.58	1298	0.14	15.09	2122	0.16
Thymol	8.76	1310	51.48	15.26	2139	51.34
Carvacrol	8.83	1315	4.20	15.48	2160	4.15
Thymyl acetate	9.47	1355	0.02	11.59	1798	0.02
α-Copaene	9.73	1373	0.02	7.15	1444	0.03
β-Bourbonene	9.84	1380	0.01	7.48	1469	0.01
Geranyl acetate	9.92	1386	0.01	10.60	1714	0.04
Unknown [m/z 148, 133 (66), 105 (46), 43 (33), 77 (15)...]	9.97	1389	0.07			
β-Caryophyllene	10.30	1413	1.28	8.44*	1541	[1.29]
Aromadendrene	10.56	1433	0.09	8.65*	1557	[1.25]
α-Humulene	10.72*	1445	0.45			
Unknown [m/z 151, 166 (40), 105 (26)...]	10.72*	1445	[0.45]			
Unknown [m/z 151, 68 (64), 55 (58), 67 (56), 81 (45), 41 (44)...]	10.82	1452	0.04			
allo-Aromadendrene	10.85	1454	0.04	9.04	1588	0.02
(*E*)-β-Farnesene	10.89*	1457	0.09	9.62*†	1634	0.07
Thymohydroquinone isomer?	10.89*	1457	[0.09]			
γ-Muurolene	11.10	1473	0.03	9.62*†	1634	[0.07]
Germacrene D	11.14	1476	0.01	9.83	1651	0.02
β-Selinene	11.19	1480	0.01	9.90	1657	0.02

allo-Aromadendr-9-ene	11.22	1482	0.01	9.62*†	1634	[0.07]
Viridiflorene	11.33	1490	0.05	9.67	1638	0.05
α-Muurolene	11.42	1497	0.03	10.07	1670	0.03
γ-Cadinene	11.58*	1509	0.06	10.42	1699	0.04
β-Bisabolene	11.58*	1509	[0.06]	10.23	1683	0.01
Cubebol	11.58*	1509	[0.06]	12.62	1888	0.01
δ-Cadinene	11.72	1520	0.10	10.45	1701	0.11
trans-Cadina-1,4-diene	11.82	1527	0.03	10.69	1722	0.02
α-Cadinene	11.89	1534	0.01	10.82	1732	0.03
Geranyl butyrate	12.25	1562	0.05	12.22	1853	0.04
Spathulenol	12.35	1570	0.07	14.49	2063	0.10
Caryophyllene oxide	12.40*	1573	0.21	12.84	1908	0.20
Caryophyllene oxide isomer	12.40*	1573	[0.21]	12.75	1900	0.02
Unknown [m/z 109, 43 (95), 81 (81), 93 (76), 69 (75), 95 (74), 107 (71)... 204 (22), 220 (6)]	12.44	1576	0.02			
Humulene epoxide II	12.73	1599	0.01	13.44	1964	0.01
Geranyl isovalerate	12.78	1603	0.01	12.28	1858	0.02
10-epi-γ-Eudesmol	12.86	1610	0.02	14.20	2036	0.02
1-epi-Cubenol	13.00	1621	0.01	13.85	2002	0.01
10,10-Dimethyl-2,6-dimethylenebicyclo[7.2.0]undecan-5β-ol?	13.10	1630	0.02			
τ-Cadinol	13.16	1635	0.03			
α-Cadinol	13.32	1648	0.03	15.57	2170	0.04
(3*Z*)-Caryophylla-3,8(13)-dien-5β-ol	13.52	1664	0.03	16.91	2308	0.03
Shyobunol	13.72	1681	0.01	16.38	2253	0.01
Unknown [m/z 81, 136 (68), 135 (58), 150 (44), 93 (34), 121 (30)...]	15.51	1836	0.02			
Unknown [m/z 81, 136 (62), 135 (56), 150 (39), 93 (33), 121 (24)...]	15.99	1880	0.05			
Unknown [m/z 136, 81 (89), 135 (71), 150 (43), 93 (42), 121 (40)...]	16.18	1898	0.10			
Unknown [m/z 136, 81 (81), 150 (74), 135 (52), 93 (46), 121 (42)...]	16.44	1923	0.01	16.00	2214	0.01
Unknown [m/z 135, 150 (90), 201 (83), 81 (52), 136 (35)... 286 (25)]	16.95	1971	0.03			
Unknown [m/z 135, 150 (61), 81 (45), 69 (37), 41 (24), 136 (21), 93 (19)...]	17.04	1980	0.01			
Unknown [m/z 135, 150 (66), 43 (38), 109 (27), 93 (25), 137 (20)...]	17.47	2022	0.01			
Unknown [m/z 135, 43 (51), 150 (36), 109 (30), 93 (27), 95 (21)...]	17.63	2038	0.01			
Unknown [m/z 163, 175 (51), 201 (40), 147 (33), 41 (31), 123 (29)... 286 (23)]	18.34	2108	0.01	20.38	2705	0.02
Unknown [m/z 69, 41 (81), 91 (37), 166 (35), 105 (33), 43 (30)...]	18.43	2118	0.01	19.99	2657	0.01
Unknown [m/z 69, 41 (74), 166 (36), 91 (32), 105 (28), 43 (25)...]	18.51	2127	0.01	20.05	2664	0.01
Unknown [m/z 175, 163 (78), 161	19.17	2195	0.01			

(33), 41 (32)... 286 (18)]		
Total identified	**98.49%**	**97.56%**
Total reported	**98.93%**	**97.66%**

*: 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

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