Date : April 13, 2021

Certificate of Analysis – GC Profiling

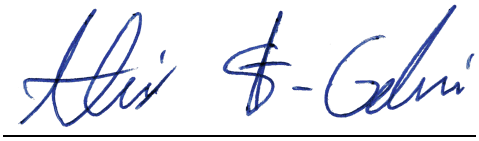
Sample identification

Internal code : 21D06-PTH23
Customer identification : Oregano - O40108204R
Type : Essential oil
Source : *Origanum vulgare* ct. Carvacrol
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 : Alexis St-Gelais, M. Sc., chimiste
Analysis date : April 13, 2021

Checked and approved by :



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

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Méthode certifiée ISO 17025:2017 Certified method

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PHYSICOCHEMICAL DATA

Physical aspect: Faintly yellow liquid
Refractive index: 1.5096 ± 0.0003 (20 °C; method PC-MAT-016)

ISO 13171:2016 (ESSENTIAL OIL OF OREGANO)

Compound	Min. %	Max. %	Observed %	Complies?
α-Thujene	0.2	1.5	0.1	No
α-Pinene	0.2	2.5	1.6	Yes
Myrcene	0.5	3.0	2.2	Yes
α-Terpinene	0.5	2.0	1.3	Yes
para-Cymene	4.0	10.0	8.4	Yes
γ-Terpinene	3.0	9.0	7.8	Yes
Linalool	tr	3.00	3.80	No
Terpinen-4-ol	0.5	2.0	0.1	No
Thymol	0.5	5.0	3.4	Yes
Carvacrol	60.0	80.0	66.3	Yes
β-Caryophyllene	0.5	4.0	0.9	Yes
Refractive index	1.5000	1.5130	1.5096	Yes

CONCLUSION

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

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Analysis summary – Consolidated contents

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

Identification	%	Class
2-Butanone	tr	Aliphatic ketone
Isovaleral	0.01	Aliphatic aldehyde
2-Methylbutyral	tr	Aliphatic aldehyde
Methyl 2-methylbutyrate	tr	Aliphatic ester
Tricyclene	0.01	Monoterpene
α-Thujene	0.08	Monoterpene
α-Pinene	1.61	Monoterpene
Camphene	0.42	Monoterpene
α-Fenchene	0.07	Monoterpene
Benzaldehyde	tr	Simple phenolic
meta-Cymene	tr	Monoterpene
Sabinene	tr	Monoterpene
β-Pinene	0.04	Monoterpene
Unknown	0.01	Monoterpene
Octen-3-ol	0.13	Aliphatic alcohol
Octan-3-one	tr	Aliphatic ketone
Myrcene	2.21	Monoterpene
α-Phellandrene	0.14	Monoterpene
Pseudolimonene	0.05	Monoterpene
Δ3-Carene	0.02	Monoterpene
α-Terpinene	1.29	Monoterpene
para-Cymene	8.36	Monoterpene
Limonene	0.07	Monoterpene
β-Phellandrene	0.04	Monoterpene
1,8-Cineole	0.06	Monoterpenic ether
(*Z*)-β-Ocimene	0.01	Monoterpene
Unknown	tr	Unknown
(*E*)-β-Ocimene	0.01	Monoterpene
γ-Terpinene	7.75	Monoterpene
cis-Sabinene hydrate	0.05	Monoterpenic alcohol
cis-Linalool oxide (fur.)	0.02	Monoterpenic alcohol
Octanol	0.01	Aliphatic alcohol
Isoterpinolene	0.01	Monoterpene
Fenchone	0.03	Monoterpenic ketone
para-Cymenene	0.02	Monoterpene
trans-Linalool oxide (fur.)	0.01	Monoterpenic alcohol
Terpinolene	0.03	Monoterpene
trans-Sabinene hydrate	0.02	Monoterpenic alcohol
Linalool	3.80	Monoterpenic alcohol
Hotrienol	0.02	Monoterpenic alcohol
endo-Fenchol	tr	Monoterpenic alcohol
Unknown	tr	Oxygenated monoterpene
cis-para-Menth-2-en-1-ol	0.01	Monoterpenic alcohol
α-Campholenal	0.01	Monoterpenic aldehyde
trans-Pinocarveol	0.01	Monoterpenic alcohol

Camphor	0.02	Monoterpenic ketone
trans-para-Menth-2-en-1-ol	0.02	Monoterpenic alcohol
Borneol	0.22	Monoterpenic alcohol
Unknown	0.01	Unknown
Terpinen-4-ol	0.14	Monoterpenic alcohol
para-Cymen-8-ol	0.01	Monoterpenic alcohol
α-Terpineol	0.04	Monoterpenic alcohol
cis-Dihydrocarvone	0.02	Monoterpenic ketone
trans-Dihydrocarvone	0.01	Monoterpenic ketone
trans-Piperitol	tr	Monoterpenic alcohol
Thymol methyl ether	0.02	Monoterpenic ether
Carvone	tr	Monoterpenic ketone
Carvacrol methyl ether	0.22	Monoterpenic ether
Geraniol	tr	Monoterpenic alcohol
Geranial	0.01	Monoterpenic aldehyde
Bornyl acetate	tr	Monoterpenic ester
Cuminol	0.02	Monoterpenic alcohol
Thymol analogue I (isothymol?)	0.01	Monoterpenic alcohol
Thymol	3.40	Monoterpenic alcohol
Carvacrol	66.32	Monoterpenic alcohol
2,3-Dihydro-3,6-dihydroxyterpinolene	0.10	Monoterpenic alcohol
2-Methyl-6-propylphenol?	0.03	Miscellanous
α-Terpinyl acetate	0.01	Monoterpenic ester
Neryl acetate	0.01	Monoterpenic ester
α-Copaene	0.01	Sesquiterpene
Carvacryl acetate	0.02	Monoterpenic ester
β-Bourbonene	0.01	Sesquiterpene
β-Elemene	0.01	Sesquiterpene
(*Z*)-Jasmone	tr	Jasmonate
Methyleugenol	0.02	Phenylpropanoid
β-Caryophyllene	0.89	Sesquiterpene
β-Copaene	0.01	Sesquiterpene
Aromadendrene	0.02	Sesquiterpene
α-Humulene	0.01	Sesquiterpene
γ-Muurolene	0.02	Sesquiterpene
allo-Aromadendr-9-ene	0.01	Sesquiterpene
Viridiflorene	0.02	Sesquiterpene
β-Bisabolene	0.35	Sesquiterpene
γ-Cadinene	0.04	Sesquiterpene
δ-Cadinene	0.02	Sesquiterpene
β-Sesquiphellandrene	0.01	Sesquiterpene
(*E*)-α-Bisabolene	0.01	Sesquiterpene
Spathulenol	0.04	Sesquiterpenic alcohol
Caryophyllene oxide	0.27	Sesquiterpenic ether
Caryophyllene oxide isomer	0.01	Sesquiterpenic ether
Humulene epoxide I	0.01	Sesquiterpenic ether
Humulene epoxide II	0.01	Sesquiterpenic ether
10-epi-Cubenol	0.01	Sesquiterpenic alcohol
Caryophylladienol I	tr	Sesquiterpenic alcohol
Caryophylladienol II	tr	Sesquiterpenic alcohol
τ-Cadinol	0.05	Sesquiterpenic alcohol
Unknown	0.01	Sesquiterpenic alcohol

α-Cadinol	tr	Sesquiterpenic alcohol
(3*Z*)-Caryophylla-3,8(13)-dien-5β-ol	0.01	Sesquiterpenic alcohol
Eudesma-4(15),7-dien-1β-ol	0.01	Sesquiterpenic alcohol
α-Bisabolol	tr	Sesquiterpenic alcohol
Phytone	tr	Terpenic ketone
Unknown	0.01	Unknown
Unknown	0.02	Unknown
Unknown	0.02	Unknown
Unknown	0.01	Unknown
meta-Camphorene	0.02	Diterpene
Unknown	0.01	Unknown
Unknown	tr	Unknown
Unknown	0.01	Unknown
para-Camphorene	0.01	Diterpene
Unknown	0.01	Unknown
Unknown	0.02	Unknown
Unknown	tr	Unknown
Unknown	0.05	Unknown
Unknown	0.01	Unknown
Unknown	0.01	Unknown
Unknown	tr	Unknown
Consolidated total	**99.22%**	

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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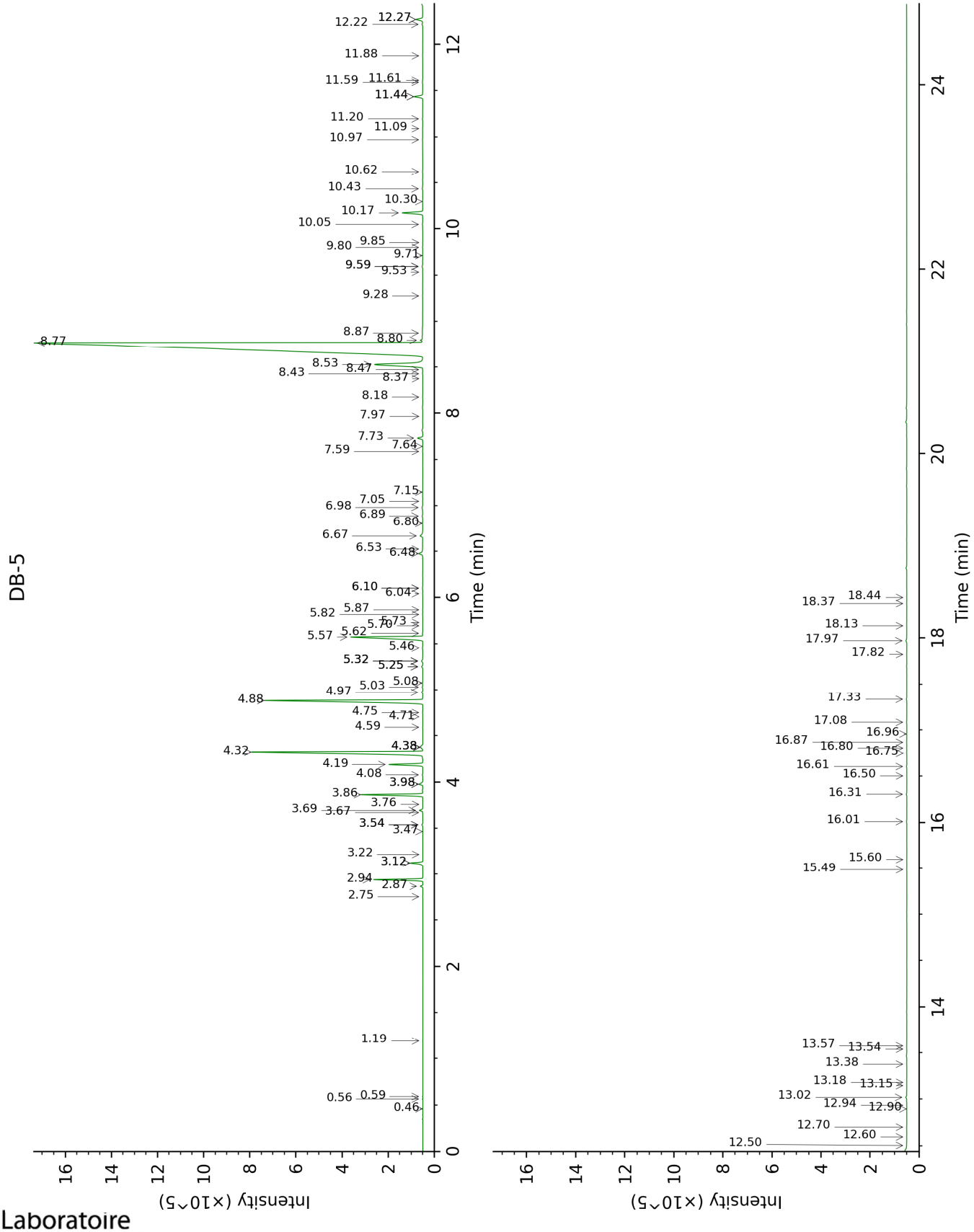
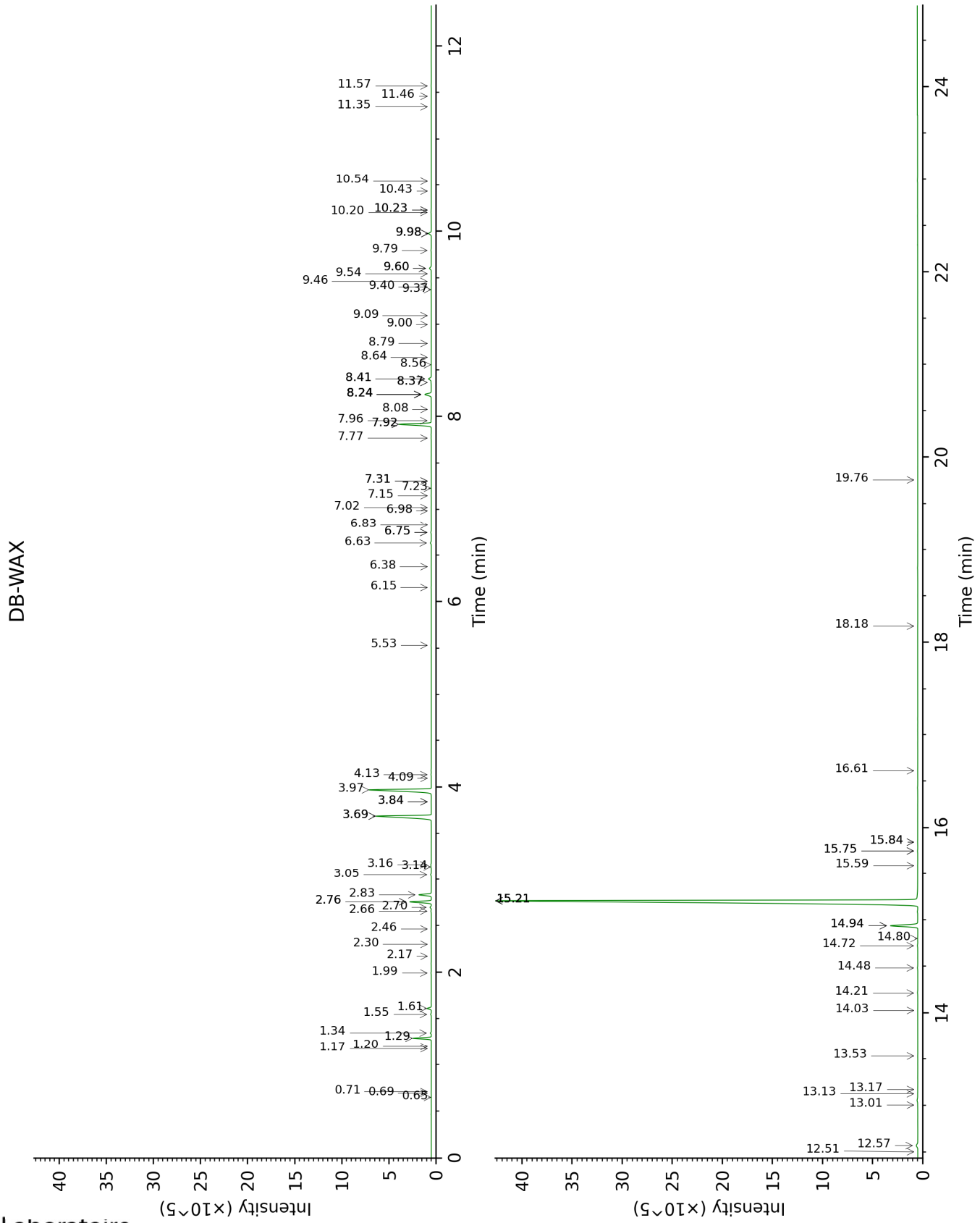

DB-5
Intensity (×10^5)
Time (min)
12.27
12.22
11.88
11.61
11.59
11.44
11.20
11.09
10.97
10.62
10.43
10.30
10.17
10.05
9.85
9.80
9.71
9.59
9.53
9.28
8.87
8.80
8.77
8.53
8.47
8.43
8.37
8.18
7.97
7.73
7.64
7.59
7.15
7.05
6.98
6.89
6.80
6.67
6.53
6.48
6.10
6.04
5.87
5.82
5.73
5.70
5.62
5.57
5.46
5.32
5.25
5.08
5.03
4.97
4.88
4.75
4.71
4.59
4.38
4.32
4.19
4.08
3.98
3.86
3.76
3.69
3.67
3.54
3.47
3.22
3.12
2.94
2.87
2.75
1.19
0.59
0.56
0.46
18.44
18.37
18.13
17.97
17.82
17.33
17.08
16.96
16.87
16.80
16.75
16.61
16.50
16.31
16.01
15.60
15.49
13.57
13.54
13.38
13.18
13.15
13.02
12.94
12.90
12.70
12.60
12.50


DB-WAX
Intensity (×10^5)
Time (min)
11.57
11.46
11.35
10.54
10.43
10.20
10.23
9.98
9.79
9.60
9.54
9.46
9.40
9.37
9.09
9.00
8.79
8.64
8.56
8.41
8.37
8.24
8.08
7.96
7.92
7.77
7.31
7.23
7.15
7.02
6.98
6.83
6.75
6.63
6.38
6.15
5.53
4.13
4.09
3.97
3.84
3.69
3.16
3.14
3.05
2.83
2.76
2.70
2.66
2.46
2.30
2.17
1.99
1.61
1.55
1.34
1.29
1.17
1.20
0.71
0.69
0.65
19.76
18.18
16.61
15.84
15.75
15.59
15.21
14.94
14.80
14.72
14.48
14.21
14.03
13.53
13.17
13.13
13.01
12.57
12.51

FULL ANALYSIS DATA

Identification	Column DB-5			Column DB-WAX		
	R.T	R.I	%	R.T	R.I	%
2-Butanone	0.46	588	tr	0.65	864	tr
Isovaleral	0.56	639	0.01	0.71	888	0.01
2-Methylbutyral	0.59	650	tr	0.69	882	0.01
Methyl 2-methylbutyrate	1.19	775	tr	1.20	977	tr
Tricyclene	2.75	919	0.01	1.17	973	0.01
α-Thujene	2.87	927	0.08	1.34	1001	0.08
α-Pinene	2.94	932	1.61	1.29	993	1.62
Camphene	3.12*	944	0.48	1.61	1028	0.42
α-Fenchene	3.12*	944	[0.48]	1.55	1022	0.07
Benzaldehyde	3.22	950	tr	7.15	1461	0.02
meta-Cymene	3.47	967	tr	2.76*	1135	2.23
Sabinene	3.54*	972	0.04	2.17	1085	tr
β-Pinene	3.54*	972	[0.04]	1.99	1066	0.04
Unknown [m/z 93, 79 (73), 67 (49), 95 (42), 91 (41), 121 (38)...]	3.67	981	0.01	2.30	1098	0.01
Octen-3-ol	3.69	983	0.13	6.63	1422	0.11
Octan-3-one	3.76	987	tr	3.84*	1220	0.01
Myrcene	3.86	994	2.21	2.76*	1135	[2.23]
α-Phellandrene	3.98*	1002	0.18	2.70	1130	0.14
Pseudolimonene	3.98*	1002	[0.18]	2.66	1127	0.05
Δ3-Carene	4.08	1008	0.02	2.46	1112	0.02
α-Terpinene	4.19	1016	1.29	2.83	1141	1.29
para-Cymene	4.32	1024	8.36	3.97	1230	8.39
Limonene	4.38*	1027	0.17	3.05	1158	0.07
β-Phellandrene	4.38*	1027	[0.17]	3.14	1165	0.04
1,8-Cineole	4.38*	1027	[0.17]	3.16	1167	0.06
(*Z*)-β-Ocimene	4.59	1041	0.01	3.69*	1209	7.79
Unknown [m/z 57, 43 (28), 41 (19), 55 (18), 95 (17), 72 (17)...]	4.71	1048	tr	7.31*	1473	0.01
(*E*)-β-Ocimene	4.75	1051	0.01	3.84*	1220	[0.01]
γ-Terpinene	4.88	1059	7.75	3.69*	1209	[7.79]
cis-Sabinene hydrate	4.97	1065	0.05	6.75*	1431	0.06
cis-Linalool oxide (fur.)	5.03	1069	0.02	6.38	1403	0.01
Octanol	5.08	1072	0.01	7.96	1522	0.04
Isoterpinolene	5.25*	1083	0.05	4.09	1239	0.01
Fenchone	5.25*	1083	[0.05]	5.53	1342	0.03
para-Cymenene	5.32*	1087	0.06	6.15	1387	0.02
trans-Linalool oxide (fur.)	5.32*	1087	[0.06]	6.75*	1431	[0.06]
Terpinolene	5.32*	1087	[0.06]	4.13	1242	0.03
trans-Sabinene hydrate	5.46	1096	0.02	7.77	1508	0.02
Linalool	5.57	1103	3.80	7.92*	1519	3.80
Hotrienol	5.62	1106	0.02	8.64	1576	0.01

endo-Fenchol	5.70	1111	tr	8.24*	1544	0.91
Unknown [m/z 109, 91 (57), 93 (47), 81 (44), 77 (40)... 154 (1)]	5.73	1113	tr			
cis-para-Menth-2-en-1-ol	5.82	1119	0.01	7.92*	1519	[3.80]
α-Campholenal	5.87	1122	0.01	6.83	1437	0.01
trans-Pinocarveol	6.04	1133	0.01	9.00	1604	tr
Camphor	6.10*	1137	0.02	7.02	1452	0.02
trans-para-Menth-2-en-1-ol	6.10*	1137	[0.02]	8.79	1588	0.02
Borneol	6.48	1161	0.22	9.60*	1653	0.26
Unknown [m/z 109, 108 (48), 67 (41), 81 (40), 41 (28)...]	6.53	1164	0.01	7.23	1467	0.01
Terpinen-4-ol	6.67	1174	0.14	8.41*	1558	0.38
para-Cymen-8-ol	6.80	1182	0.01	11.35	1800	0.02
α-Terpineol	6.89†	1188	0.09	9.60*	1653	[0.26]
cis-Dihydrocarvone	6.98†	1194	[0.09]	8.37*	1554	0.05
trans-Dihydrocarvone	7.05	1198	0.01	8.56	1569	0.01
trans-Piperitol	7.15	1204	tr	10.23*	1705	0.02
Thymol methyl ether	7.59	1234	0.02	8.24*	1544	[0.91]
Carvone	7.64	1238	tr	9.79	1669	0.04
Carvacrol methyl ether	7.73	1244	0.22	8.41*	1558	[0.38]
Geraniol	7.97	1259	tr	11.46	1810	0.01
Geranial	8.18	1273	0.01	9.98*	1684	0.36
Bornyl acetate	8.37	1287	tr	8.08	1532	0.01
Cuminol	8.43	1290	0.02	14.03	2047	0.02
Thymol analogue I (isothymol?)	8.47	1293	0.01	14.80	2123	0.02
Thymol	8.53	1297	3.40	14.94*	2137	3.27
Carvacrol	8.77	1314	66.32	15.20*	2164	66.54
2,3-Dihydro-3,6-dihydroxyterpinolene	8.80	1316	0.10			
2-Methyl-6-propylphenol?	8.87	1321	0.03			
α-Terpinyl acetate	9.28	1350	0.01	9.54	1648	0.01
Neryl acetate	9.53	1368	0.01	9.98*	1684	[0.36]
α-Copaene	9.59*	1372	0.04	6.98	1449	0.01
Carvacryl acetate	9.59*	1372	[0.04]	11.57	1820	0.02
β-Bourbonene	9.71	1380	0.01	7.31*	1473	[0.01]
β-Elemene	9.80	1387	0.01	8.24*	1544	[0.91]
(*Z*)-Jasmone	9.85	1390	tr			
Methyleugenol	10.05	1404	0.02	13.13	1961	0.03
β-Caryophyllene	10.17	1414	0.89	8.24*	1544	[0.91]
β-Copaene	10.30	1423	0.01	8.24*	1544	[0.91]
Aromadendrene	10.43	1433	0.02	8.37*	1554	[0.05]
α-Humulene	10.62	1447	0.01	9.09	1612	0.02
γ-Muurolene	10.97	1473	0.02	9.40	1637	0.02

allo-Aromadendr-9-ene	11.09	1482	0.01	9.37	1635	0.01
Viridiflorene	11.20	1490	0.02	9.46	1642	0.02
β-Bisabolene	11.44*	1508	0.39	9.98*	1684	[0.36]
γ-Cadinene	11.44*	1508	[0.39]	10.20	1702	0.04
δ-Cadinene	11.59	1520	0.02	10.23*	1705	[0.02]
β-Sesquiphellandrene	11.61	1522	0.01	10.43	1722	0.01
(*E*)-α-Bisabolene	11.88	1543	0.01	10.54	1731	0.01
Spathulenol	12.22	1570	0.04	14.21	2065	0.04
Caryophyllene oxide	12.27*	1574	0.32	12.57	1910	0.27
Caryophyllene oxide isomer	12.27*	1574	[0.32]	12.50	1904	0.01
Humulene epoxide I	12.50	1592	0.01	13.00	1950	0.02
Humulene epoxide II	12.60	1600	0.01	13.17	1966	0.01
10-epi-Cubenol	12.70	1608	0.01	13.53	1999	0.01
Caryophylladienol I	12.90	1624	tr	15.84*	2229	0.03
Caryophylladienol II	12.94	1627	tr	15.84*	2229	[0.03]
τ-Cadinol	13.02	1634	0.05	14.72	2115	0.05
Unknown cadinol analog II [m/z 95, 121 (73), 43 (57), 79 (43), 161 (43), 109)40)... 204 (35), 222 (2)]	13.15	1645	0.01	14.94*	2137	[3.27]
α-Cadinol	13.18	1648	tr	15.20*	2164	[66.54]
(3*Z*)-Caryophylla-3,8(13)-dien-5β-ol	13.38	1664	0.01	16.61	2310	0.01
Eudesma-4(15),7-dien-1β-ol	13.54	1677	0.01	15.75*	2219	0.03
α-Bisabolol	13.58	1680	tr	15.20*	2164	[66.54]
Phytone	15.49	1847	tr	14.48	2091	0.04
Unknown [m/z 81, 150 (90), 136 (88), 135 (74), 93 (54), 121 (41)...]	15.60	1857	0.01			
Unknown [m/z 81, 150 (83), 136 (81), 135 (67), 93 (48), 121 (36)...]	16.01	1895	0.02			
Unknown [m/z 136, 81 (81), 150 (74), 135 (52), 93 (46), 121 (42)...]	16.31	1922	0.02	15.75*	2219	[0.03]
Unknown [m/z 81, 136 (71), 150 (57), 93 (47), 135 (42)...]	16.50	1941	0.01			
meta-Camphorene	16.61	1951	0.02	15.20*	2164	[66.54]
Unknown [m/z 151, 135 (46), 109 (41), 43 (26), 150 (24), 107 (23)...]	16.75	1965	0.01			

Unknown [m/z 93, 132 (36), 69 (31), 41 (25), 136 (25), 147 (23)...]	16.80	1970	tr			
Unknown [m/z 150, 135 (59), 81 (32), 136 (26), 257 (21)...]	16.87	1976	0.01			
para-Camphorene	16.96	1985	0.01	15.59	2202	0.01
Unknown [m/z 99, 43 (43), 69 (37), 71 (37), 41 (28)...]	17.08	1997	0.01			
Unknown [m/z 135, 150 (66), 43 (38), 109 (27), 93 (25), 137 (20)...]	17.33	2021	0.02	18.18	2482	0.01
Unknown [m/z 135, 150 (78), 109 (38), 43 (20), 93 (19), 91 (18)...]	17.82	2070	tr			
Unknown [m/z 135, 150 (71), 43 (55), 93 (36), 109 (36), 91 (28)...]	17.97	2085	0.05			
Unknown [m/z 255, 270 (52), 119 (31), 122 (26), 91 (22), 256 (22)...]	18.13	2101	0.01			
Unknown [m/z 69, 41 (74), 166 (36), 91 (32), 105 (28), 43 (25)...]	18.37	2126	0.01	19.76	2668	tr
Unknown [m/z 201, 241 (93), 159 (74), 302 (57), 259 (38), 43 (29)...]	18.44	2132	tr			
Total identified		**99.10%**			**99.19%**	
Total reported		**99.31%**			**99.23%**	

*: 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