Date : September 26, 2019

Certificate of Analysis – GC Profiling

Sample identification

Internal code : 19I12-PTH08-1-SCC
Customer identification : Oregano Org - Spain - O5010793R
Type : Essential oil
Source : *Origanum vulgare* ct. Carvacrol
Customer : Plant Therapy

Analysis

Method: PC-PA-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 : Lindsay Girard, B. Sc.
Analysis date : September 24, 2019

Checked and approved by :

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

Notes: This report may not be published, including online, without the written consent from Laboratoire PhytoChemia. This report is digitally signed, it is only considered valid if the digital signature is intact. The results only describe the samples that were submitted to the assays.

Laboratoire PhytoChemia
628 Boulevard du Saguenay Ouest, Saguenay (Qc) G7J 1H4 | www.phytochemia.com

PHYSICOCHEMICAL DATA

Physical aspect: Yellow viscous liquid
Refractive index: 1.5089 ± 0.0003 (20 °C)

ISO 13171:2016 (ESSENTIAL OIL OF OREGANO)

Compound	Min. %	Max. %	Observed %	Complies?
β-Caryophyllene	0.5	4.0	2.3	Yes
Carvacrol	60.0	80.0	69.4	Yes
Thymol	0.5	5.0	3.8	Yes
Terpinen-4-ol	0.5	2.0	0.6	Yes
Linalool	tr	3.00	1.53	Yes
γ-Terpinene	3.0	9.0	6.0	Yes
para-Cymene	4.0	10.0	7.3	Yes
α-Terpinene	0.5	2.0	0.9	Yes
Myrcene	0.5	3.0	1.2	Yes
α-Pinene	0.2	2.5	1.0	Yes
α-Thujene	0.2	1.5	0.7	Yes
Refractive index	1.5000	1.5130	1.5089	Yes

CONCLUSION

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

Analysis summary – Consolidated contents

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

Identification	%	Classe
Ethanol	0.02	Aliphatic alcohol
Acetone	0.01	Aliphatic ketone
Isobutanol	tr	Aliphatic alcohol
Isovaleral	0.02	Aliphatic aldehyde
2-Methylbutyral	0.01	Aliphatic aldehyde
Isoamyl alcohol	tr	Aliphatic alcohol
2-Methylbutanol	tr	Aliphatic alcohol
Methyl 2-methylbutyrate	0.07	Aliphatic ester
Octane	tr	Alkane
Furfural	0.01	Aliphatic alcohol
(2*E*)-Hexenal	0.01	Aliphatic aldehyde
(3*Z*)-Hexenol	0.02	Aliphatic alcohol
Hexanol	0.01	Aliphatic alcohol
Heptan-3-one	0.01	Aliphatic ketone
Hashishene	0.01	Monoterpene
Tricyclene	0.01	Monoterpene
α-Thujene	0.70	Monoterpene
α-Pinene	1.01	Monoterpene
Camphene	0.11	Monoterpene
Thuja-2,4(10)-diene	tr	Monoterpene
β-Pinene	0.11	Monoterpene
Sabinene	0.01	Monoterpene
Octen-3-ol	0.38	Aliphatic alcohol
Octan-3-one	0.20	Aliphatic ketone
Myrcene	1.25	Monoterpene
α-Phellandrene	0.15	Monoterpene
Δ3-Carene	0.07	Monoterpene
α-Terpinene	0.89	Monoterpene
para-Cymene	7.31	Monoterpene
Limonene	0.24	Monoterpene
1,8-Cineole	0.23*	Monoterpenic ether
β-Phellandrene	[0.23]*	Monoterpene
(*Z*)-β-Ocimene	0.01	Monoterpene
(*E*)-β-Ocimene	0.05	Monoterpene
γ-Terpinene	5.96	Monoterpene
cis-Sabinene hydrate	0.20	Monoterpenic alcohol
para-Mentha-3,8-diene	0.01	Monoterpene
cis-Linalool oxide (fur.)	0.01	Monoterpenic alcohol
Terpinolene	0.10	Monoterpene
trans-Linalool oxide (fur.)	tr	Monoterpenic alcohol
trans-Sabinene hydrate	0.09	Monoterpenic alcohol
Linalool	1.53	Monoterpenic alcohol
Hotrienol	0.02	Monoterpenic alcohol
endo-Fenchol	0.03	Monoterpenic alcohol
cis-para-Menth-2-en-1-ol	0.03	Monoterpenic alcohol
trans-Pinocarveol	0.01	Monoterpenic alcohol
Camphor	0.08	Monoterpenic ketone

trans-para-Menth-2-en-1-ol	0.01	Monoterpenic alcohol
Isoborneol	0.01	Monoterpenic alcohol
Unknown	0.01	Unknown
Borneol	0.24	Monoterpenic alcohol
Terpinen-4-ol	0.63	Monoterpenic alcohol
para-Cymen-8-ol	0.03	Monoterpenic alcohol
α-Terpineol	0.06	Monoterpenic alcohol
Myrtenal	0.03	Monoterpenic aldehyde
trans-Dihydrocarvone	0.08	Monoterpenic ketone
trans-Piperitol	0.05	Monoterpenic alcohol
trans-Carveol	0.01	Monoterpenic alcohol
Nerol	0.01	Monoterpenic alcohol
Thymol methyl ether analog I	0.01	Monoterpenic ether
Carvacrol methyl ether	0.07	Monoterpenic ether
Carvenone	0.02	Monoterpenic ketone
Geraniol	0.03	Monoterpenic alcohol
Geranial	0.02	Monoterpenic aldehyde
Cuminol	0.02	Monoterpenic alcohol
Thymol	3.77	Monoterpenic alcohol
Carvacrol	69.36	Monoterpenic alcohol
2-Methyl-6-propylphenol?	0.02	Miscellanous
α-Copaene	0.02	Sesquiterpene
β-Elemene	0.03	Sesquiterpene
Methyleugenol	0.01	Phenylpropanoid
β-Caryophyllene	2.26	Sesquiterpene
α-Humulene	0.22	Sesquiterpene
allo-Aromadendrene	0.01	Sesquiterpene
γ-Muurolene	0.01	Sesquiterpene
allo-Aromadendr-9-ene	0.01	Sesquiterpene
δ-Selinene	0.01	Sesquiterpene
α-Muurolene	0.01	Sesquiterpene
β-Bisabolene	0.35	Sesquiterpene
δ-Cadinene	0.02	Sesquiterpene
Caryophyllene oxide	0.19	Sesquiterpenic ether
Caryophyllene oxide isomer	0.02	Sesquiterpenic ether
Humulene epoxide II	0.02	Sesquiterpenic ether
Caryophylladienol II	0.02	Sesquiterpenic alcohol
τ-Cadinol	0.01	Sesquiterpenic alcohol
Unknown	0.01	Oxygenated sesquiterpene
(3*Z*)-Caryophylla-3,8(13)-dien-5β-ol	0.02	Sesquiterpenic alcohol
α-Bisabolol	0.01	Sesquiterpenic alcohol
Phytone	0.01	Terpenic ketone
Unknown	0.03	Unknown
Unknown	0.01	Unknown
Unknown	0.01	Unknown
Unknown	0.07	Unknown
Unknown	0.01	Unknown
Unknown	0.07	Unknown
Unknown	0.02	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	**99.09%**	

*: 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.

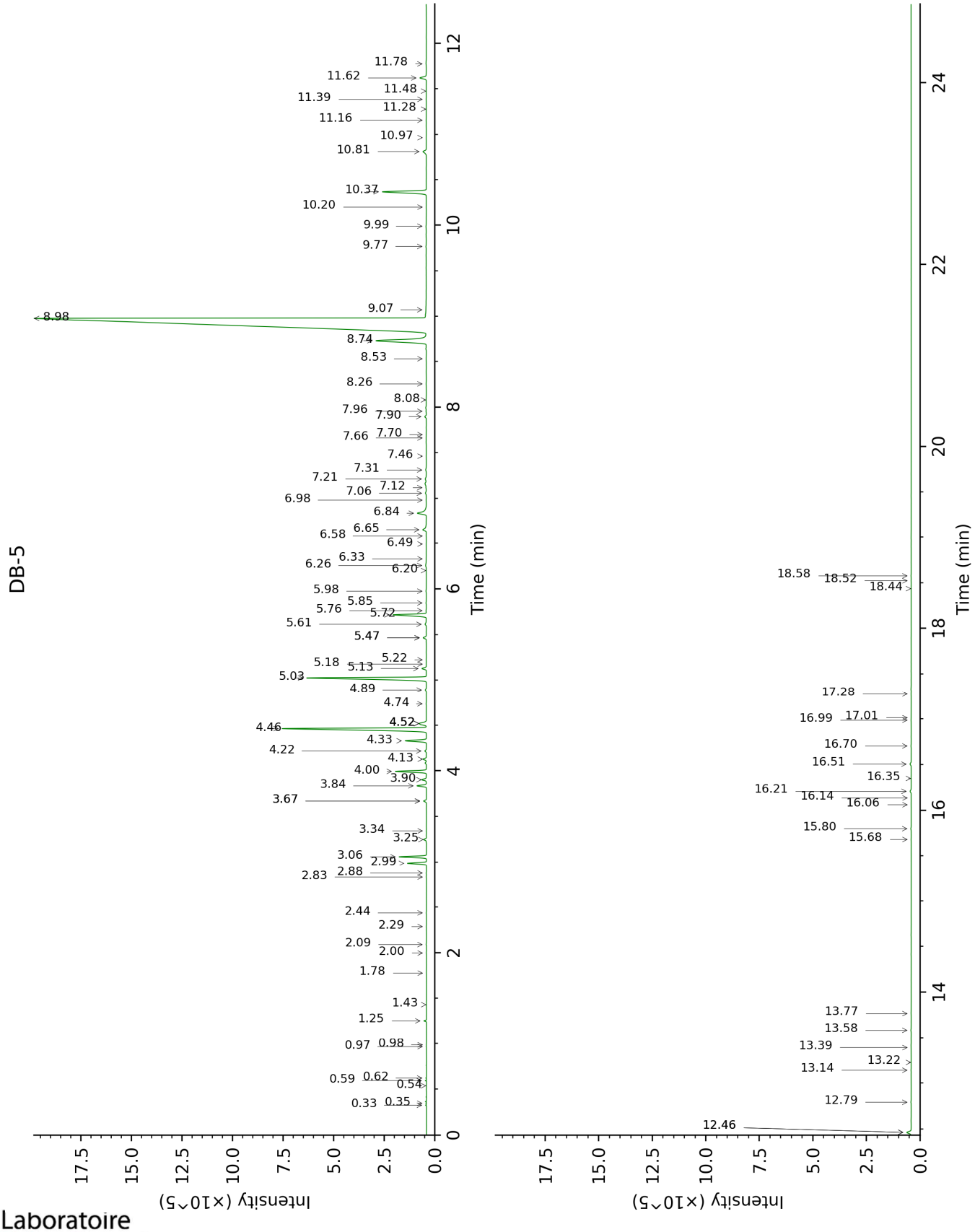
Note: no correction factor was applied

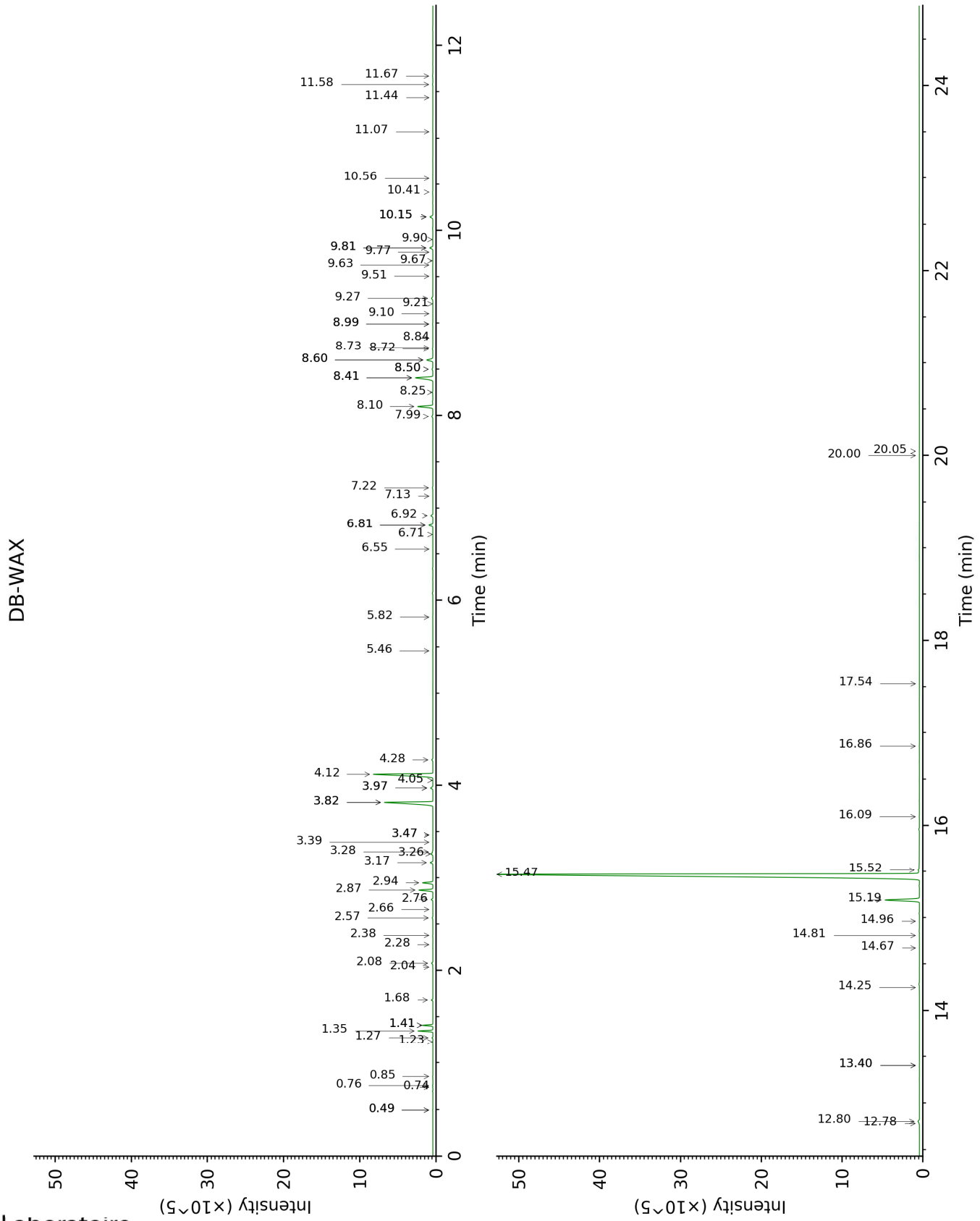
About "consolidated" data: The table above presents the breakdown of the sample volatile constituents after applying an algorithm to collapse data acquired from the multi-columns system of PhytoChemia into a single set of consolidated contents. In case of discrepancies between columns, the algorithm 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.

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

628 Boulevard du Saguenay, Saguenay (Qc) G7J 1H4 | www.phytochemia.com


DB-5
Time (min)
Intensity (×10^5)
11.78
11.62
11.48
11.39
11.28
11.16
10.97
10.81
10.37
10.20
9.99
9.77
9.07
8.98
8.74
8.53
8.26
8.08
7.96
7.90
7.66
7.70
7.46
7.31
7.21
7.12
7.06
6.98
6.84
6.65
6.58
6.49
6.33
6.26
6.20
5.98
5.85
5.76
5.72
5.61
5.47
5.22
5.18
5.13
5.03
4.89
4.74
4.52
4.46
4.33
4.22
4.13
4.00
3.90
3.84
3.67
3.34
3.25
3.06
2.99
2.88
2.83
2.44
2.29
2.09
2.00
1.78
1.43
1.25
0.98
0.97
0.62
0.59
0.54
0.35
0.33
18.58
18.52
18.44
17.28
17.01
16.99
16.70
16.51
16.35
16.21
16.14
16.06
15.80
15.68
13.77
13.58
13.39
13.22
13.14
12.79
12.46


DB-WAX
Time (min)
Intensity (×10^5)
11.58
11.67
11.44
11.07
10.56
10.41
10.15
9.90
9.81
9.77
9.67
9.63
9.51
9.27
9.21
9.10
8.99
8.84
8.73
8.72
8.60
8.50
8.41
8.25
8.10
7.99
7.22
7.13
6.92
6.81
6.71
6.55
5.82
5.46
4.28
4.12
4.05
3.97
3.82
3.47
3.39
3.28
3.26
3.17
2.94
2.87
2.76
2.66
2.57
2.38
2.28
2.08
2.04
1.68
1.41
1.35
1.27
1.23
0.85
0.76
0.74
0.49
20.00
20.05
17.54
16.86
16.09
15.52
15.47
15.19
14.96
14.81
14.67
14.25
13.40
12.80
12.78

FULL ANALYSIS DATA

Identification	Column DB-5			Column DB-WAX		
	R.T	R.I	%	R.T	R.I	%
Ethanol	0.33	519	0.02	0.85	908	0.01
Acetone	0.35	519	0.01	0.49*	779	0.01
Isobutanol	0.54	619	tr	2.04	1060	0.01
Isovaleral	0.60	640	0.02	0.76	886	0.02
2-Methylbutyral	0.62	650	0.01	0.74	880	0.01
Isoamyl alcohol	0.97	736	tr	3.47*	1178	0.01
2-Methylbutanol	0.98	738	tr	3.47*	1178	[0.01]
Methyl 2-methylbutyrate	1.25	775	0.07	1.27	977	0.06
Octane	1.43	800	tr	0.49*	779	[0.01]
Furfural	1.78	831	0.01	6.71	1414	0.01
(2*E*)-Hexenal	2.00	849	0.01	3.39	1172	0.01
(3*Z*)-Hexenol	2.09	856	0.02	5.82	1350	0.02
Hexanol	2.29	873	0.01	5.46	1324	0.01
Heptan-3-one	2.44	885	0.01	2.66	1116	0.01
Hashishene	2.83	915	0.01	1.41*	998	0.70
Tricyclene	2.88	918	0.01	1.23	969	0.01
α-Thujene	2.99	925	0.70	1.41*	998	[0.70]
α-Pinene	3.06	930	1.01	1.35	989	1.02
Camphene	3.25	942	0.11	1.68	1025	0.11
Thuja-2,4(10)-diene	3.34	948	tr	2.28	1084	0.02
β-Pinene	3.67*	970	0.12	2.08	1064	0.11
Sabinene	3.67*	970	[0.12]	2.38	1093	0.01
Octen-3-ol	3.84	981	0.38	6.81*	1421	0.38
Octan-3-one	3.90	985	0.20	3.97*	1216	0.24
Myrcene	4.00	991	1.25	2.87	1132	1.26
α-Phellandrene	4.13	1000	0.15	2.76	1124	0.14
Δ3-Carene	4.22	1006	0.07	2.57	1108	0.07
α-Terpinene	4.33	1013	0.89	2.94	1138	0.90
para-Cymene	4.46	1021	7.31	4.12	1227	7.25
Limonene	4.52*	1025	0.47	3.17	1155	0.24
1,8-Cineole	4.52*	1025	[0.47]	3.28†	1164	[0.24]
β-Phellandrene	4.52*	1025	[0.47]	3.26†	1163	0.24
(*Z*)-β-Ocimene	4.74	1039	0.01	3.82*	1205	5.99
(*E*)-β-Ocimene	4.89	1048	0.05	3.97*	1216	[0.24]
γ-Terpinene	5.03	1057	5.96	3.82*	1205	[5.99]
cis-Sabinene hydrate	5.13	1063	0.20	6.92	1429	0.20
para-Mentha-3,8-diene	5.18	1066	0.01	4.06	1222	0.01
cis-Linalool oxide (fur.)	5.22	1069	0.01	6.55	1402	0.01
Terpinolene	5.47*	1085	0.15	4.28	1238	0.10
trans-Linalool oxide (fur.)	5.47*	1085	[0.15]	6.81*	1421	[0.38]
trans-Sabinene hydrate	5.61	1094	0.09	7.99	1508	0.10

Linalool	5.72	1101	1.53	8.10	1516	1.53
Hotrienol	5.76	1104	0.02	8.84	1573	0.01
endo-Fenchol	5.85	1109	0.03	8.50*	1547	0.09
cis-para-Menth-2-en-1-ol	5.98	1117	0.03	8.25	1528	0.03
trans-Pinocarveol	6.20	1132	0.01	9.21	1602	0.01
Camphor	6.26	1136	0.08	7.22	1451	0.06
trans-para-Menth-2-en-1-ol	6.33	1140	0.01	8.99*	1584	0.03
Isoborneol	6.49	1151	0.01	9.51	1625	0.01
Unknown [m/z 123, 81 (46), 43 (45), 95 (34), 166 (30)]	6.58	1157	0.01	8.99*	1584	[0.03]
Borneol	6.65	1161	0.24	9.81*	1650	0.34
Terpinen-4-ol	6.84	1173	0.63	8.60*	1554	0.70
para-Cymen-8-ol	6.98	1183	0.03	11.58	1796	0.04
α-Terpineol	7.06	1188	0.06	9.81*	1650	[0.34]
Myrtenal	7.12	1192	0.03	8.74	1565	0.01
trans-Dihydrocarvone	7.21	1198	0.08	8.72	1564	0.05
trans-Piperitol	7.31	1204	0.05	10.41	1698	0.03
trans-Carveol	7.46	1215	0.01	11.44	1784	0.01
Nerol	7.66	1228	0.01	11.07	1753	0.01
Thymol methyl ether analog I	7.70	1231	0.01	8.41*	1540	2.20
Carvacrol methyl ether	7.90	1244	0.07	8.60*	1554	[0.70]
Carvenone	7.96	1249	0.02	9.90	1657	0.03
Geraniol	8.08	1257	0.03	11.67	1804	0.06
Geranial	8.26	1269	0.02	10.15*	1677	0.33
Cuminol	8.53	1288	0.02	14.25	2039	0.02
Thymol	8.74	1303	3.77	15.19	2131	3.77
Carvacrol	8.98	1314	69.36	15.47	2158	69.20
2-Methyl-6-propylphenol?	9.07	1321	0.02			
α-Copaene	9.77	1370	0.02	7.13	1445	0.01
β-Elemene	9.99	1386	0.03	8.50*	1547	[0.09]
Methyleugenol	10.20	1401	0.01	13.40*	1959	0.02
β-Caryophyllene	10.37	1413	2.26	8.41*	1540	[2.20]
α-Humulene	10.82	1447	0.22	9.27	1606	0.16
allo-Aromadendrene	10.97	1458	0.01	9.10	1593	0.01
γ-Muurolene	11.16	1473	0.01	9.67	1639	0.02
allo-Aromadendr-9-ene	11.28	1482	0.01	9.63	1635	0.02
δ-Selinene	11.39	1490	0.01	9.77	1646	0.01
α-Muurolene	11.48	1496	0.01	10.15*	1677	[0.33]
β-Bisabolene	11.62	1507	0.35	10.15*	1677	[0.33]
δ-Cadinene	11.78	1520	0.02	10.56	1711	0.02
Caryophyllene oxide	12.46*	1574	0.24	12.80	1904	0.19

Caryophyllene oxide isomer	12.46*	1574	[0.24]	12.78	1902	0.02
Humulene epoxide II	12.79	1600	0.02	13.40*	1959	[0.02]
Caryophylladienol II	13.14	1628	0.02	16.10	2222	0.01
τ-Cadinol	13.22	1635	0.01	14.96	2108	0.02
Unknown [m/z 161, 59 (67), 95 (45), 93 (40), 105 (40), 149 (39), 81 (39), 43 (38), 204 (37)... 220 (5)]	13.39	1649	0.01	14.67	2080	0.01
(3*Z*)-Caryophylla-3,8(13)-dien-5β-ol	13.58	1665	0.02	16.86	2301	0.02
α-Bisabolol	13.77	1680	0.01	15.52	2163	0.15
Phytone	15.68	1847	0.01	14.81	2093	0.02
Unknown [m/z 81, 150 (90), 136 (88), 135 (74), 93 (54), 121 (41)...]	15.80	1858	0.03			
Unknown [m/z 93, 135 (57), 43 (41), 91 (39), 150 (22)...]	16.06	1882	0.01			
Unknown [m/z 133, 150 (34), 105 (22), 135 (16), 134 (12)...]	16.14	1889	0.01			
Unknown [m/z 81, 150 (83), 136 (81), 135 (67), 93 (48), 121 (36)...]	16.21	1895	0.07			
Unknown [m/z 93, 149 (98), 150 (85), 135 (55), 43 (29)...]	16.35	1908	0.01			
Unknown [m/z 136, 81 (81), 150 (74), 135 (52), 93 (46), 121 (42)...]	16.51	1923	0.07			
Unknown [m/z 81, 136 (71), 150 (57), 93 (47), 135 (42)...]	16.70	1942	0.02			
Unknown [m/z 93, 132 (36), 69 (31), 41 (25), 136 (25), 147 (23)...]	16.99	1969	0.01			
Unknown [m/z 150, 135 (59), 81 (32), 136 (26), 257	17.01	1971	0.01			

(21)...]						
Unknown [m/z 99, 43 (43), 69 (37), 71 (37), 41 (28)...]	17.28	1996	0.01	17.54	2375	0.01
Unknown [m/z 255, 270 (52), 119 (31), 122 (26), 91 (22), 256 (22)...]	18.44	2111	0.01			
Unknown [m/z 69, 41 (81), 91 (37), 166 (35), 105 (33), 43 (30)...]	18.52	2120	0.01	20.00	2659	0.01
Unknown [m/z 69, 41 (74), 166 (36), 91 (32), 105 (28), 43 (25)...]	18.58	2126	0.01	20.05	2664	0.01
Total identified		**98.85%**			**98.56%**	
Total reported		**99.14%**			**98.59%**	

*: 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