Date : May 22, 2020

Certificate of Analysis – GC Profiling

Sample identification

Internal code : 20E08-PTH01
Customer identification : Oregano - Turkey - O4010699R
Type : Essential oil
Source : *Origanum vulgare* ct. Carvacrol
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 : Fanny Charlier, B. Sc.
Analysis date : May 11, 2020

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Notes: This report may not be published, including online, without the written consent from Laboratoire PhytoChemia.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: Faintly yellow liquid
Refractive index: 1.5119 ± 0.0003 (20 °C; method PC-MAT-016)

ISO 13171:2016 (ESSENTIAL OIL OF OREGANO)

Compound	Min. %	Max. %	Observed %	Complies?
β-Caryophyllene	0.5	4.0	2.7	Yes
Carvacrol	60.0	80.0	70.6	Yes
Thymol	0.5	5.0	3.4	Yes
Terpinen-4-ol	0.5	2.0	1.2	Yes
Linalool	tr	3.00	1.89	Yes
γ-Terpinene	3.0	9.0	5.6	Yes
para-Cymene	4.0	10.0	6.3	Yes
α-Terpinene	0.5	2.0	1.3	Yes
Myrcene	0.5	3.0	0.9	Yes
α-Pinene	0.2	2.5	1.3	Yes
α-Thujene	0.2	1.5	0.5	Yes
Refractive index	1.5000	1.5130	1.5119	Yes

CONCLUSION

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

Analysis summary – Consolidated contents

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

Identification	%	Class
Isovaleral	0.01	Aliphatic aldehyde
2-Methylbutyral	0.01	Aliphatic aldehyde
Methyl 2-methylbutyrate	0.01	Aliphatic ester
Octane	tr	Alkane
Tricyclene	tr	Monoterpene
α-Thujene	0.52	Monoterpene
α-Pinene	1.26	Monoterpene
Camphene	0.06	Monoterpene
α-Fenchene	tr	Monoterpene
β-Pinene	0.04	Monoterpene
Octen-3-ol	0.06	Aliphatic alcohol
Myrcene	0.86	Monoterpene
trans-Dehydroxylinalool oxide	tr	Monoterpenic ether
Pseudolimonene	0.01	Monoterpene
α-Phellandrene	0.08	Monoterpene
Δ3-Carene	0.03	Monoterpene
α-Terpinene	1.34	Monoterpene
Carvomenthene	0.01	Aliphatic alcohol
ortho-Cymene	tr	Monoterpene
para-Cymene	6.27	Monoterpene
1,8-Cineole	0.21	Monoterpenic ether
Limonene	0.08	Monoterpene
β-Phellandrene	0.05	Monoterpene
(*Z*)-β-Ocimene	0.02	Monoterpene
(*E*)-β-Ocimene	0.03	Monoterpene
γ-Terpinene	5.56	Monoterpene
cis-Sabinene hydrate	0.04	Monoterpenic alcohol
cis-Linalool oxide (fur.)	0.01	Monoterpenic alcohol
Terpinolene	0.07	Monoterpene
trans-Linalool oxide (fur.)	0.01	Monoterpenic alcohol
trans-Sabinene hydrate	0.04	Monoterpenic alcohol
Linalool	1.89	Monoterpenic alcohol
Hotrienol	0.02	Monoterpenic alcohol
cis-para-Menth-2-en-1-ol	0.02	Monoterpenic alcohol
α-Campholenal	0.01	Monoterpenic aldehyde
trans-Pinocarveol	0.01	Monoterpenic alcohol
trans-para-Menth-2-en-1-ol	0.01	Monoterpenic alcohol
Borneol	0.20	Monoterpenic alcohol
Unknown	0.01	Unknown
Umbellulone	0.01	Monoterpenic ketone
Terpinen-4-ol	1.19	Monoterpenic alcohol
α-Terpineol	0.02	Monoterpenic alcohol
Myrtenal	0.02	Monoterpenic aldehyde
γ-Terpineol	0.01	Monoterpenic alcohol
cis-Dihydrocarvone	0.02	Monoterpenic ketone

Dihydrocarveol	0.01	Monoterpenic alcohol
Thymol methyl ether	0.06	Monoterpenic ether
Carvacrol methyl ether	0.02	Monoterpenic ether
Geranial	tr	Monoterpenic aldehyde
Cuminol	0.04	Monoterpenic alcohol
Thymol analogue I	0.02	Monoterpenic alcohol
Thymol	3.43	Monoterpenic alcohol
Carvacrol	70.62	Monoterpenic alcohol
2-Methyl-6-propylphenol?	0.02	Miscellanous
Neryl acetate	0.01	Monoterpenic ester
Carvacryl acetate	0.06	Monoterpenic ester
α-Copaene	0.01	Sesquiterpene
β-Bourbonene	0.01	Sesquiterpene
Geranyl acetate	0.02	Monoterpenic ester
β-Elemene	0.02	Sesquiterpene
Isocaryophyllene	0.01	Sesquiterpene
Methyleugenol	0.01	Phenylpropanoid
β-Caryophyllene	2.72	Sesquiterpene
cis-α-Bergamotene	0.01	Sesquiterpene
β-Copaene	0.02	Sesquiterpene
Aromadendrene	0.10	Sesquiterpene
α-Humulene	0.19	Sesquiterpene
Unknown	0.01	Oxygenated monoterpene
allo-Aromadendrene	0.02	Sesquiterpene
γ-Muurolene	0.01	Sesquiterpene
Viridiflorene	0.09	Sesquiterpene
γ-Cadinene	0.04	Sesquiterpene
β-Bisabolene	0.49	Sesquiterpene
δ-Cadinene	0.03	Sesquiterpene
trans-Calamenene	0.01	Sesquiterpene
α-Calacorene	0.02	Sesquiterpene
(*E*)-α-Bisabolene	0.02	Sesquiterpene
Caryophyllene oxide	0.14	Sesquiterpenic ether
Caryophyllene oxide isomer	0.02	Sesquiterpenic ether
Unknown	0.02	Oxygenated sesquiterpene
Humulene epoxide II	0.01	Sesquiterpenic ether
10-epi-Cubenol	0.01	Sesquiterpenic alcohol
Caryophylladienol II	0.01	Sesquiterpenic alcohol
τ-Cadinol	0.05	Sesquiterpenic alcohol
Unknown	0.01	Oxygenated sesquiterpene
(3*Z*)-Caryophylla-3,8(13)-dien-5β-ol	0.02	Sesquiterpenic alcohol
Eudesma-4(15),7-dien-1β-ol	0.01	Sesquiterpenic alcohol
Unknown	0.01	Unknown
Unknown	0.01	Unknown
Unknown	0.03	Unknown
Unknown	0.07	Unknown
Unknown	0.02	Unknown
meta-Camphorene	0.03	Diterpene
Unknown	0.04	Unknown
para-Camphorene	0.01	Diterpene
Unknown	0.01	Unknown
Unknown	0.02	Unknown

Unknown	0.01	Unknown
Unknown	0.01	Unknown
Unknown	0.02	Unknown
Consolidated total	**98.90%**	

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

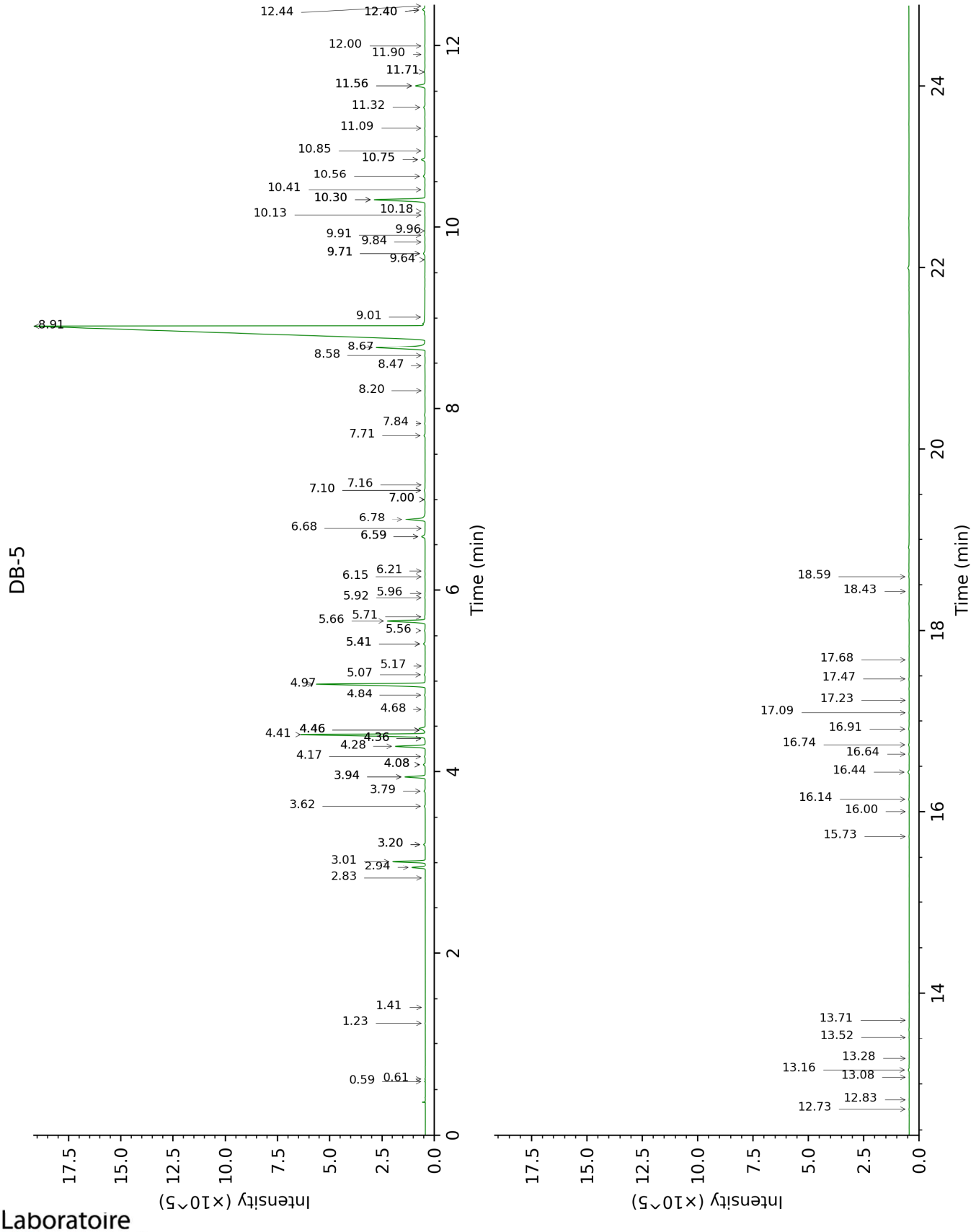
Note: no correction factor was applied

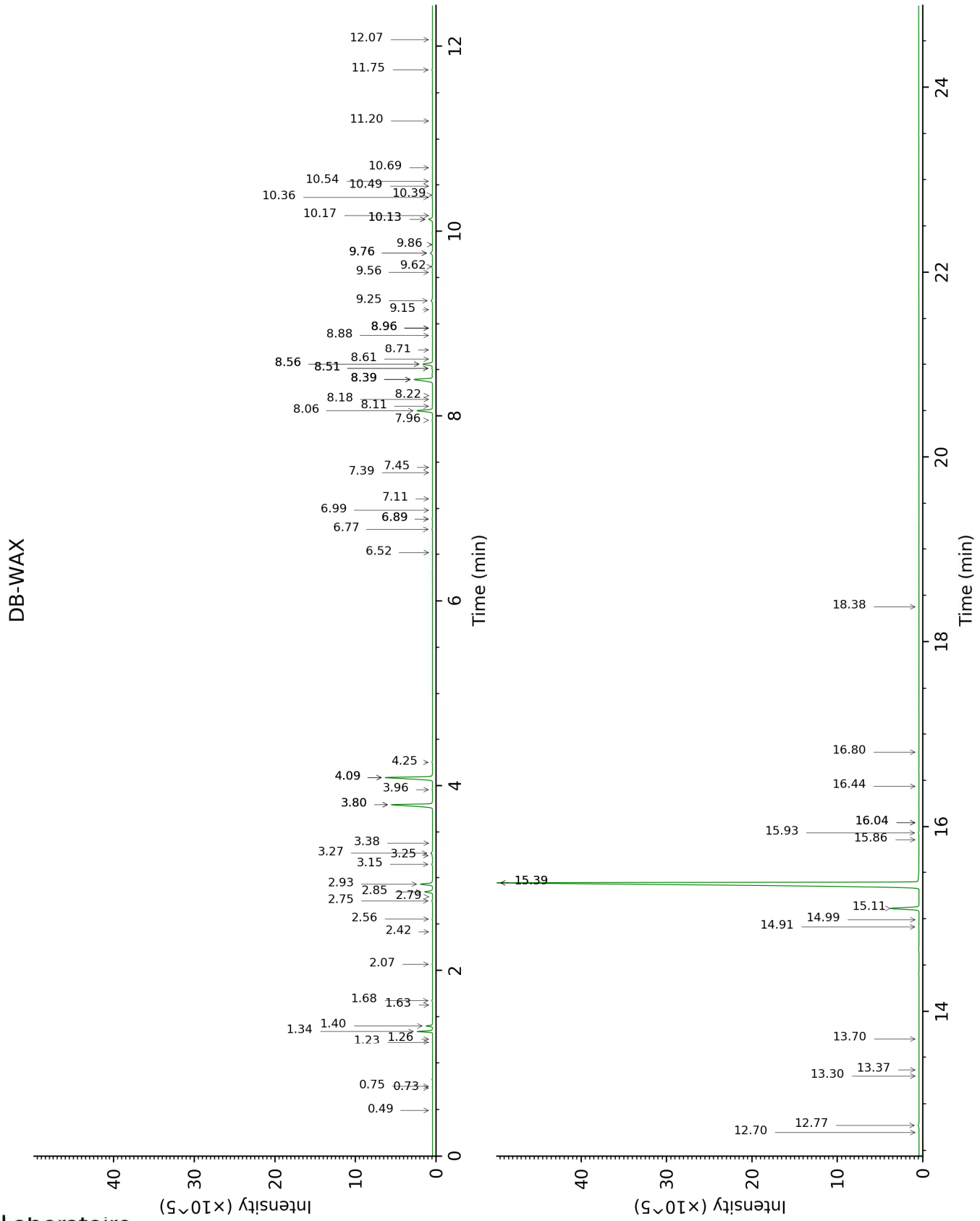
About "consolidated" data: The table above presents the breakdown of the sample volatile constituents after applying an algorithm to collapse data acquired from the multi-columns system of PhytoChemia into a single set of consolidated contents. In case of discrepancies between columns, the algorithm 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)
12.44
12.40
12.00
11.90
11.71
11.56
11.32
11.09
10.85
10.75
10.56
10.41
10.30
10.18
10.13
9.96
9.91
9.84
9.71
9.64
9.01
8.91
8.67
8.58
8.47
8.20
7.84
7.71
7.16
7.10
7.00
6.78
6.68
6.59
6.21
6.15
5.96
5.92
5.71
5.66
5.56
5.41
5.17
5.07
4.97
4.84
4.68
4.46
4.41
4.36
4.28
4.17
4.08
3.94
3.79
3.62
3.20
3.01
2.94
2.83
1.41
1.23
0.61
0.59
18.59
18.43
17.68
17.47
17.23
17.09
16.91
16.74
16.64
16.44
16.14
16.00
15.73
13.71
13.52
13.28
13.16
13.08
12.83
12.73


DB-WAX
Intensity (×10^5)
Time (min)
12.07
11.75
11.20
10.69
10.54
10.49
10.36
10.39
10.17
10.13
9.86
9.76
9.62
9.56
9.25
9.15
8.96
8.88
8.71
8.61
8.56
8.51
8.39
8.22
8.18
8.11
8.06
7.96
7.45
7.39
7.11
6.99
6.89
6.77
6.52
4.25
4.09
3.96
3.80
3.38
3.27
3.25
3.15
2.93
2.85
2.79
2.75
2.56
2.42
2.07
1.68
1.63
1.40
1.34
1.26
1.23
0.75
0.73
0.49
18.38
16.80
16.44
16.04
15.93
15.86
15.39
15.11
14.99
14.91
13.70
13.37
13.30
12.77
12.70

FULL ANALYSIS DATA

Identification	Column DB-5			Column DB-WAX		
	R.T	R.I	%	R.T	R.I	%
Isovaleral	0.59	640	0.01	0.75	887	0.01
2-Methylbutyral	0.62	652	0.01	0.73	880	0.01
Methyl 2-methylbutyrate	1.23	778	0.01	1.26	977	0.01
Octane	1.41	802	tr	0.49	783	0.01
Tricyclene	2.83	918	tr	1.22	971	tr
α-Thujene	2.94	926	0.52	1.40	998	0.52
α-Pinene	3.01	930	1.26	1.34	990	1.24
Camphene	3.20*	942	0.07	1.68	1025	0.06
α-Fenchene	3.20*	942	[0.07]	1.63	1021	tr
β-Pinene	3.62	970	0.04	2.07	1064	0.04
Octen-3-ol	3.79	981	0.06	6.77	1419	0.06
Myrcene	3.94*	992	0.86	2.85	1132	0.86
trans-Dehydroxylinalool oxide	3.94*	992	[0.86]	3.38	1174	tr
Pseudolimonene	4.08*	1000	0.09	2.80	1128	0.01
α-Phellandrene	4.08*	1000	[0.09]	2.75	1124	0.08
Δ3-Carene	4.17	1006	0.03	2.56	1109	0.04
α-Terpinene	4.28	1013	1.34	2.93	1138	1.34
Carvomenthene	4.36*	1018	0.02	2.42	1098	0.01
ortho-Cymene	4.36*	1018	[0.02]	4.09*	1227	6.27
para-Cymene	4.41	1021	6.27	4.09*	1227	[6.27]
1,8-Cineole	4.46*†	1024	0.35	3.27	1165	0.21
Limonene	4.46*†	1024	[0.35]	3.15	1156	0.08
β-Phellandrene	4.46*†	1024	[0.35]	3.25	1163	0.05
(*Z*)-β-Ocimene	4.68	1039	0.02	3.80*	1206	5.54
(*E*)-β-Ocimene	4.84	1049	0.03	3.96	1218	0.04
γ-Terpinene	4.97	1057	5.56	3.80*	1206	[5.54]
cis-Sabinene hydrate	5.07	1063	0.04	6.89*	1428	0.05
cis-Linalool oxide (fur.)	5.17	1069	0.01	6.52	1400	0.01
Terpinolene	5.41*	1085	0.09	4.25	1239	0.07
trans-Linalool oxide (fur.)	5.41*	1085	[0.09]	6.89*	1428	[0.05]
trans-Sabinene hydrate	5.56	1094	0.04	7.96	1508	0.05
Linalool	5.66	1101	1.89	8.06	1516	1.90
Hotrienol	5.71	1104	0.02	8.88	1579	0.02
cis-para-Menth-2-en-1-ol	5.92	1117	0.02	8.11	1519	0.04
α-Campholenal	5.96	1120	0.01	6.98	1435	0.01
trans-Pinocarveol	6.15	1132	0.01	9.15	1601	0.01
trans-para-Menth-2-en-1-ol	6.21	1136	0.01	8.96*	1585	0.02
Borneol	6.59*	1161	0.21	9.76*	1650	0.29
Unknown [m/z	6.59*	1161	[0.21]	7.39	1465	0.01

109, 108 (48), 67 (41), 81 (40), 41 (28)...]						
Umbellulone	6.68	1166	0.01	8.96*	1585	[0.02]
Terpinen-4-ol	6.78	1173	1.19	8.56*	1554	1.22
α-Terpineol	7.00*	1188	0.04	9.76*	1650	[0.29]
Myrtenal	7.00*	1188	[0.04]	8.71	1566	0.02
γ-Terpineol	7.10*	1194	0.05	9.86	1657	0.01
cis-Dihydrocarvone	7.10*	1194	[0.05]	8.51*	1551	0.08
Dihydrocarveol	7.16	1198	0.01	10.49	1709	0.01
Thymol methyl ether	7.70	1235	0.06	8.51*	1551	[0.08]
Carvacrol methyl ether	7.84	1244	0.02	8.61	1559	0.01
Geranial	8.20	1269	tr	10.13*	1679	0.49
Cuminol	8.47	1288	0.04			
Thymol analogue I	8.58	1296	0.02	14.99	2118	0.01
Thymol	8.67	1302	3.43	15.11	2130	3.47
Carvacrol	8.91	1314	70.62	15.39*	2157	70.39
2-Methyl-6-propylphenol?	9.01	1321	0.02			
Neryl acetate	9.64	1366	0.01	10.17	1683	0.01
Carvacryl acetate	9.71*	1370	0.11	11.75	1816	0.06
α-Copaene	9.71*	1370	[0.11]	7.11	1444	0.01
β-Bourbonene	9.84	1379	0.01	7.45	1469	0.01
Geranyl acetate	9.91	1384	0.02	10.54	1714	0.02
β-Elemene	9.96	1388	0.02	8.39*	1542	2.76
Isocaryophyllene	10.13	1400	0.01	8.18	1525	0.01
Methyleugenol	10.18	1403	0.01	13.30	1956	0.01
β-Caryophyllene	10.30*	1412	2.78	8.39*	1542	[2.76]
cis-α-Bergamotene	10.30*	1412	[2.78]	8.22	1528	0.01
β-Copaene	10.41	1421	0.02	8.39*	1542	[2.76]
Aromadendrene	10.56	1432	0.10	8.56*	1554	[1.22]
α-Humulene	10.75*	1446	0.20	9.25	1608	0.19
Unknown [m/z 151, 166 (40), 105 (26)...]	10.75*	1446	[0.20]			
allo-Aromadendrene	10.84	1453	0.02	8.96*	1585	[0.02]
γ-Muurolene	11.09	1472	0.01	9.56	1633	0.04
Viridiflorene	11.32	1489	0.09	9.62	1638	0.08
γ-Cadinene	11.56*	1506	0.54	10.36	1699	0.04
β-Bisabolene	11.56*	1506	[0.54]	10.13*	1679	[0.49]
δ-Cadinene	11.71*	1518	0.05	10.39	1701	0.03
trans-Calamenene	11.71*	1518	[0.05]	11.20	1769	0.01
α-Calacorene	11.90	1533	0.02	12.07	1845	0.02
(*E*)-α-Bisabolene	12.00	1541	0.02	10.69	1726	0.02
Caryophyllene oxide	12.40*	1572	0.15	12.77	1908	0.14

Caryophyllene oxide isomer	12.40*	1572	[0.15]	12.70	1901	0.02
Unknown [m/z 109, 43 (95), 81 (81), 93 (76), 69 (75), 95 (74), 107 (71)... 204 (22), 220 (6)]	12.44	1575	0.02			
Humulene epoxide II	12.73	1598	0.01	13.37	1962	0.02
10-epi-Cubenol	12.83	1606	0.01	13.70	1993	0.02
Caryophylladienol II	13.08	1627	0.01	16.04*	2224	0.01
τ-Cadinol	13.16	1633	0.05	14.91	2110	0.06
Unknown [m/z 81, 93 (84), 41 (70), 79 (61), 55 (56), 123 (55), 95 (54), 107 (50)... 220 (t)]	13.28	1644	0.01	16.44	2264	0.01
(3*Z*)-Caryophylla-3,8(13)-dien-5β-ol	13.52	1663	0.02	16.80	2303	0.01
Eudesma-4(15),7-dien-1β-ol	13.71	1679	0.01	16.04*	2224	[0.01]
Unknown [m/z 81, 150 (90), 136 (88), 135 (74), 93 (54), 121 (41)...]	15.73	1856	0.01			
Unknown [m/z 93, 135 (57), 43 (41), 91 (39), 150 (22)...]	16.00	1881	0.01			
Unknown [m/z 81, 150 (83), 136 (81), 135 (67), 93 (48), 121 (36)...]	16.14	1893	0.03			
Unknown [m/z 136, 81 (81), 150 (74), 135 (52), 93 (46), 121 (42)...]	16.44	1921	0.07	15.93	2212	0.08
Unknown [m/z 81, 136 (71), 150 (57), 93 (47), 135 (42)...]	16.64	1940	0.02			
meta-Camphorene	16.74	1950	0.03	15.39*	2157	[70.39]
Unknown [m/z 151, 135 (46), 109 (41), 43 (26), 150 (24), 107 (23)...]	16.91	1966	0.04			
para-Camphorene	17.09	1983	0.01	15.86	2205	0.01
Unknown [m/z 99, 43 (43), 69 (37), 71 (37), 41 (28)...]	17.23	1996	0.01			
Unknown [m/z	17.47	2020	0.02	18.38	2475	0.01

135, 150 (66), 43 (38), 109 (27), 93 (25), 137 (20)...]				
Unknown [m/z 135, 150 (95), 93 (41), 109 (34), 43 (20)...]	17.68	2041	0.01	
Unknown [m/z 69, 41 (81), 91 (37), 166 (35), 105 (33), 43 (30)...]	18.43	2116	0.01	
Unknown [m/z 201, 241 (93), 159 (74), 302 (57), 259 (38), 43 (29)...]	18.59	2133	0.02	
Total identified		**98.78%**		**98.27%**
Total reported		**99.05%**		**98.38%**

*: 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