

Date : July 7, 2020

CERTIFICATE OF ANALYSIS – GC PROFILING

SAMPLE IDENTIFICATION

Internal code : 20E21-PTH05

Customer identification : Oregano Organic - Greece - O5010887R

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 : Sylvain Mercier, M. Sc., Chimiste

Analysis date : May 22, 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Notes: This report may not be published, including online, without the written consent from Laboratoire PhytoChemia.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.

This report is an update of the first version issued on May 25, 2020, for a minor correction.

PHYSICOCHEMICAL DATA

Physical aspect: Orange liquid

Refractive index: 1.5121 ± 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	1.1	Yes
Carvacrol	60.0	80.0	76.0	Yes
Thymol	0.5	5.0	3.7	Yes
Terpinen-4-ol	0.5	2.0	0.6	Yes
Linalool	tr	3.00	0.12	Yes
γ-Terpinene	3.0	9.0	2.4	No
para-Cymene	4.0	10.0	6.7	Yes
α-Terpinene	0.5	2.0	0.6	Yes
Myrcene	0.5	3.0	0.8	Yes
α-Pinene	0.2	2.5	0.5	Yes
α-Thujene	0.2	1.5	0.2	Yes
Refractive index	1.5000	1.5130	1.5121	Yes

CONCLUSION

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

ANALYSIS SUMMARY – CONSOLIDATED CONTENTS

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

Identification	%	Class
Ethanol	0.01	Aliphatic alcohol
Isobutyral	0.01	Aliphatic aldehyde
Isobutanol	tr	Aliphatic alcohol
Isovaleral	0.03	Aliphatic aldehyde
2-Methylbutyral	0.03	Aliphatic aldehyde
2-Ethylfuran	tr	Furan
Methyl 2-methylbutyrate	0.03	Aliphatic ester
Heptan-3-one	tr	Aliphatic ketone
Hashishene	0.01	Monoterpene
Tricyclene	0.01	Monoterpene
α -Thujene	0.24	Monoterpene
α -Pinene	0.47	Monoterpene
Unknown	0.03	Monoterpene
Camphene	0.16	Monoterpene
Thuja-2,4(10)-diene	0.02	Monoterpene
β -Pinene	0.10	Monoterpene
Sabinene	tr	Monoterpene
Octen-3-ol	0.40	Aliphatic alcohol
Octan-3-one	0.13	Aliphatic ketone
Myrcene	0.75	Monoterpene
Octan-3-ol	0.03	Aliphatic alcohol
α -Phellandrene	0.10	Monoterpene
Pseudolimonene	0.01	Monoterpene
Δ^3 -Carene	0.05	Monoterpene
α -Terpinene	0.65	Monoterpene
para-Cymene	6.66	Monoterpene
Limonene	0.16	Monoterpene
β -Phellandrene	0.14	Monoterpene
1,8-Cineole	0.11	Monoterpenic ether
(Z)- β -Ocimene	0.04	Monoterpene
(E)- β -Ocimene	0.04	Monoterpene
γ -Terpinene	2.43	Monoterpene
cis-Sabinene hydrate	0.11	Monoterpenic alcohol
cis-Linalool oxide (fur.)	0.01	Monoterpenic alcohol
Terpinolene	0.09	Monoterpene
trans-Linalool oxide (fur.)	0.01	Monoterpenic alcohol
para-Cymenene	0.10	Monoterpene
trans-Sabinene hydrate	0.09	Monoterpenic alcohol
Linalool	0.12	Monoterpenic alcohol
endo-Fenchol	0.01	Monoterpenic alcohol
Unknown	0.08	Oxygenated monoterpene
cis-para-Menth-2-en-1-ol	0.04	Monoterpenic alcohol
trans-Pinocarveol	0.02	Monoterpenic alcohol
Camphor	0.01	Monoterpenic ketone
trans-para-Menth-2-en-1-ol	0.02	Monoterpenic alcohol

Isoborneol	0.01	Monoterpenic alcohol
Borneol	0.46	Monoterpenic alcohol
Unknown	0.06	Unknown
Terpinen-4-ol	0.64	Monoterpenic alcohol
para-Cymen-8-ol	0.07	Monoterpenic alcohol
α -Terpineol	0.12	Monoterpenic alcohol
Myrtenal	0.02	Monoterpenic aldehyde
<i>cis</i> -Dihydrocarvone	0.16	Monoterpenic ketone
Dihydrocarveol	0.12	Monoterpenic alcohol
<i>trans</i> -Piperitol	0.05	Monoterpenic alcohol
Thymol methyl ether analog I	0.01	Monoterpenic ether
Carvone	0.02	Monoterpenic ketone
Carvacrol methyl ether	0.25	Monoterpenic ether
Geraniol	0.05	Monoterpenic alcohol
Geranial	0.01	Monoterpenic aldehyde
Unknown	0.04	Unknown
Bornyl acetate	0.02	Monoterpenic ester
Thymol analogue I	0.04	Monoterpenic alcohol
Thymol	3.66	Monoterpenic alcohol
Thymol analogue II	0.05	Monoterpenic alcohol
Carvacrol	76.04	Monoterpenic alcohol
2-Methyl-5-(propan-2-ylidene)cyclohexane-1,4-diol ?	0.10	Monoterpenic alcohol
2-Methyl-6-propylphenol?	0.01	Miscellaneous
α -Terpinyl acetate	0.01	Monoterpenic ester
α -Copaene	0.02	Sesquiterpene
Carvacryl acetate	0.03	Monoterpenic ester
1,5-diepi- β -Bourbonene	0.04	Sesquiterpene
β -Bourbonene	0.02	Sesquiterpene
Geranyl acetate	0.02	Monoterpenic ester
β -Elemene	0.01	Sesquiterpene
Isocaryophyllene	0.01	Sesquiterpene
β -Caryophyllene	1.06	Sesquiterpene
<i>cis</i> - α -Bergamotene	0.01	Sesquiterpene
β -Copaene	0.01	Sesquiterpene
Aromadendrene	0.05	Sesquiterpene
Selina-5,11-diene	0.01	Sesquiterpene
Unknown	0.15	Oxygenated monoterpene
α -Humulene	0.14	Sesquiterpene
allo-Aromadendrene	0.04	Sesquiterpene
<i>cis</i> -Muurolo-4(15),5-diene	0.01	Sesquiterpene
(<i>E</i>)- β -Farnesene	0.02	Sesquiterpene
<i>trans</i> -Cadina-1(6),4-diene	0.02	Sesquiterpene
γ -Muurolole	0.05	Sesquiterpene
Germacrene D	0.01	Sesquiterpene
allo-Aromadendr-9-ene	0.02	Sesquiterpene
α -Selinene	0.04	Sesquiterpene
α -Muurolole	0.01	Sesquiterpene
(3 <i>Z</i> ,6 <i>E</i>)- α -Farnesene	0.03	Sesquiterpene
β -Bisabolene	0.95	Sesquiterpene
γ -Cadinene	0.01	Sesquiterpene
Sesquicineole	0.03	Sesquiterpenic ether

<i>trans</i> -Calamenene	0.02	Sesquiterpene
δ-Cadinene	tr	Sesquiterpene
β-Sesquiphellandrene	0.03	Sesquiterpene
10- <i>epi</i> -Cubebol?	0.02	Sesquiterpenic alcohol
α-Calacorene	0.01	Sesquiterpene
(<i>E</i>)-α-Bisabolene	0.02	Sesquiterpene
Spathulenol	0.03	Sesquiterpenic alcohol
Caryophyllene oxide	0.22	Sesquiterpenic ether
Caryophyllene oxide isomer	0.01	Sesquiterpenic ether
Humulene epoxide I	0.01	Sesquiterpenic ether
Humulene epoxide II	0.03	Sesquiterpenic ether
10- <i>epi</i> -Cubenol	0.01	Sesquiterpenic alcohol
Caryophylladienol I	0.01	Sesquiterpenic alcohol
Caryophylladienol II	0.02	Sesquiterpenic alcohol
τ-Cadinol	0.01	Sesquiterpenic alcohol
Unknown	0.01	Oxygenated sesquiterpene
(3 <i>Z</i>)-Caryophylla-3,8(13)-dien-5β-ol	0.02	Sesquiterpenic alcohol
α-Bisabolol	0.01	Sesquiterpenic alcohol
Phytone	0.01	Terpenic ketone
Unknown	0.01	Unknown
Unknown	0.01	Unknown
Unknown	0.01	Unknown
Unknown	0.04	Unknown
Unknown	0.01	Unknown
Unknown	0.09	Unknown
Unknown	0.02	Unknown
Unknown	0.02	Unknown
Unknown	0.01	Unknown
Unknown	0.01	Unknown
Unknown	0.01	Unknown
Unknown	0.03	Unknown
Consolidated total	99.20%	

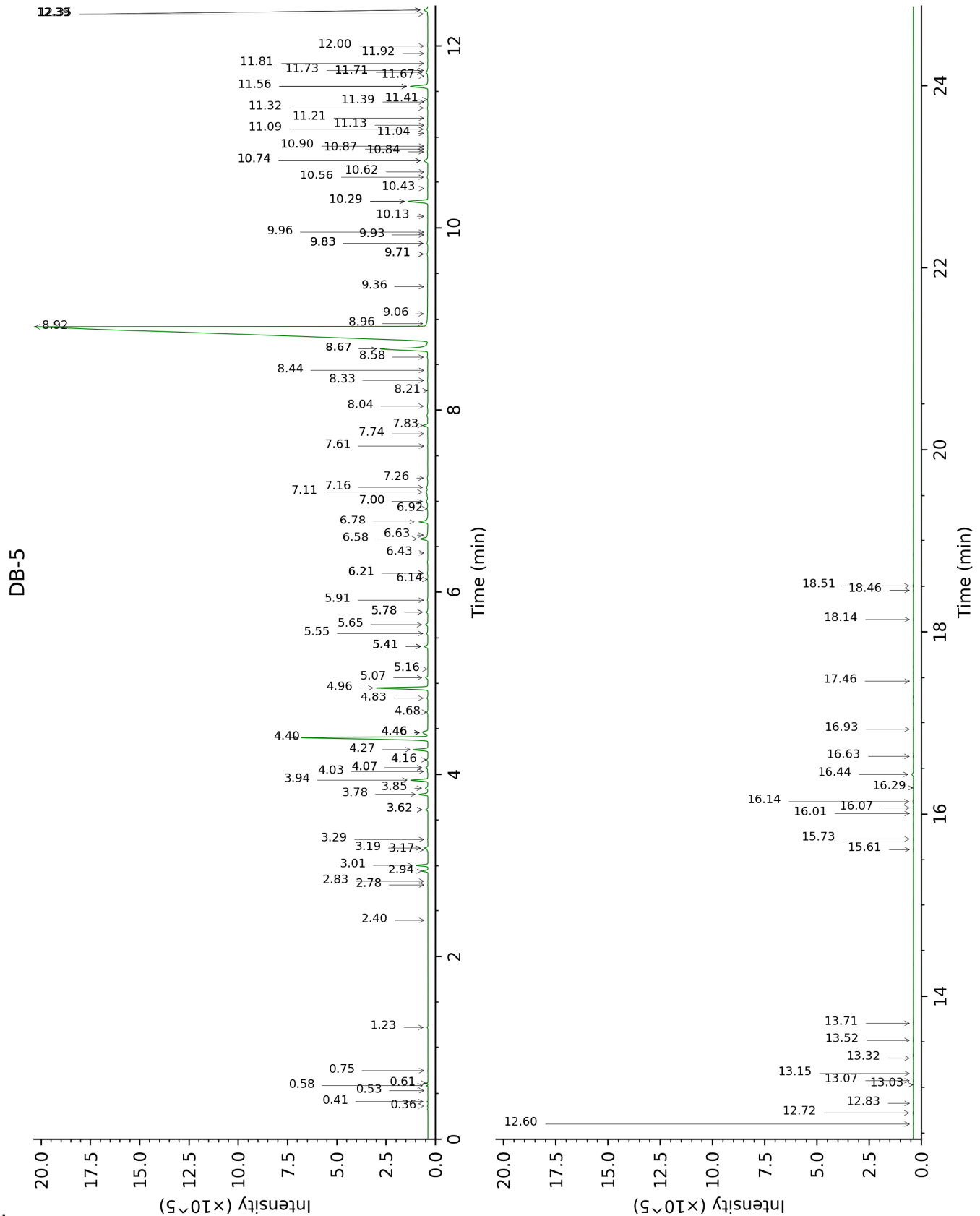
tr: The compound has been detected below 0.005% of total signal.

Note: no correction factor was applied

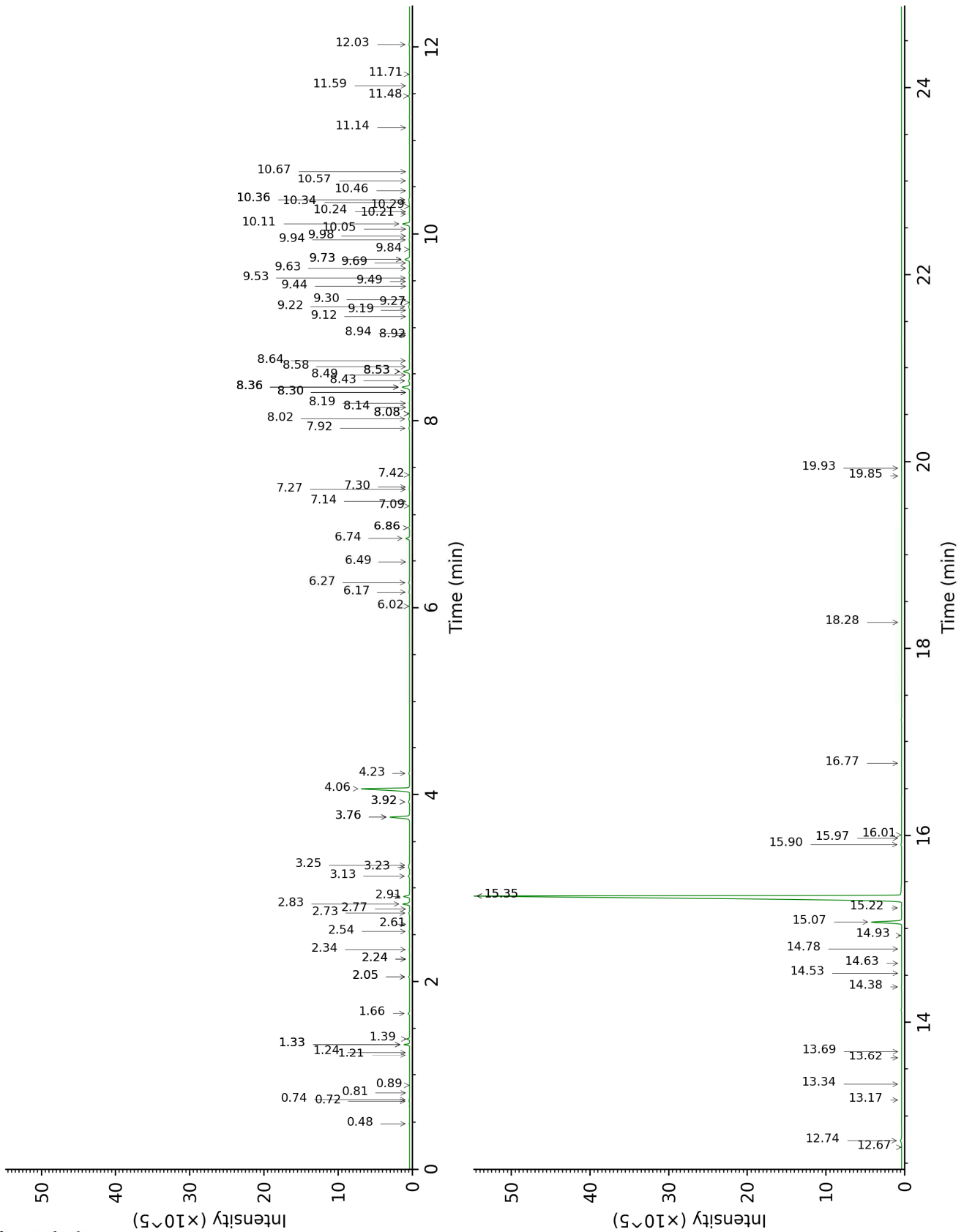
About "consolidated" data: The table above presents the breakdown of the sample volatile constituents after applying an algorithm to collapse data acquired from the multi-columns system of PhytoChemia into a single set of consolidated contents. In case of discrepancies between columns, the algorithm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



DB-WAX



FULL ANALYSIS DATA

Identification	Column DB-5			Column DB-WAX		
	R.T	R.I	%	R.T	R.I	%
Ethanol	0.36	522	0.01	0.81	908	0.01
Isobutyral	0.41	529	0.01	0.48	784	0.02
Isobutanol	0.53	616	tr	2.05*	1067	0.10
Isovaleral	0.58	640	0.03	0.74	888	0.03
2-Methylbutyral	0.61	651	0.03	0.72	882	0.03
2-Ethylfuran	0.75	707	tr	0.89	921	tr
Methyl 2-methylbutyrate	1.23	777	0.03	1.24	978	0.02
Heptan-3-one	2.40	886	tr	2.61	1118	0.01
Hashishene	2.78	915	0.01	1.33*	992	0.47
Tricyclene	2.82	918	0.01	1.21	973	0.01
α -Thujene	2.94	925	0.24	1.39	1001	0.24
α -Pinene	3.01	930	0.47	1.33*	992	[0.47]
Unknown [m/z 91, 92 (47), 65 (11)... 134 (1)]	3.17	941	0.03	2.34	1096	0.04
Camphene	3.20	942	0.16	1.66	1028	0.15
Thuja-2,4(10)-diene	3.29	948	0.02	2.24*	1085	0.02
β -Pinene	3.62*	970	0.10	2.05*	1067	[0.10]
Sabinene	3.62*	970	[0.10]	2.24*	1085	[0.02]
Octen-3-ol	3.78	981	0.40	6.74	1421	0.43
Octan-3-one	3.85	985	0.13	3.92*	1220	0.16
Myrcene	3.94	991	0.75	2.83	1135	0.75
Octan-3-ol	4.03	997	0.03	6.02	1368	0.03
α -Phellandrene	4.07*	1000	0.11	2.73	1127	0.10
Pseudolimonene	4.07*	1000	[0.11]	2.77	1130	0.01
Δ 3-Carene	4.16	1006	0.05	2.54	1112	0.05
α -Terpinene	4.27	1013	0.65	2.91	1141	0.66
para-Cymene	4.40	1021	6.66	4.06	1230	6.65
Limonene	4.46*†	1024	0.40	3.13	1159	0.16
β -Phellandrene	4.46*†	1024	[0.40]	3.23	1166	0.14
1,8-Cineole	4.46*†	1024	[0.40]	3.25	1168	0.11
(Z)- β -Ocimene	4.68	1038	0.04	3.76*	1208	2.47
(E)- β -Ocimene	4.84	1048	0.04	3.92*	1220	[0.16]
γ -Terpinene	4.96	1056	2.43	3.76*	1208	[2.47]
cis-Sabinene hydrate	5.07	1063	0.11	6.86*	1430	0.12
cis-Linalool oxide (fur.)	5.16	1069	0.01	6.49	1403	0.01
Terpinolene	5.41*	1084	0.19	4.23	1243	0.09
trans-Linalool oxide (fur.)	5.41*	1084	[0.19]	6.86*	1430	[0.12]
para-Cymenene	5.41*	1084	[0.19]	6.27	1386	0.10
trans-Sabinene hydrate	5.55	1093	0.09	7.92	1510	0.09
Linalool	5.65	1100	0.12	8.02	1518	0.12
endo-Fenchol	5.78*	1108	0.08	8.30*	1540	0.02
Unknown [m/z 109, 81 (54), 91 (32), 79 (22)...]	5.78*	1108	[0.08]	6.17	1379	0.08

<i>cis</i> -para-Menth-2-en-1-ol	5.91	1117	0.04	8.08*	1522	0.05
<i>trans</i> -Pinocarveol	6.14	1132	0.02	9.12	1604	0.02
Camphor	6.21*	1136	0.04	7.14	1451	0.01
<i>trans</i> -para-Menth-2-en-1-ol	6.21*	1136	[0.04]	8.94	1590	0.02
Isoborneol	6.43	1150	0.01	9.30	1618	0.02
Borneol	6.58	1160	0.46	9.73*	1653	0.68
Unknown [m/z 109, 108 (48), 67 (41), 81 (40), 41 (28)...]	6.63	1163	0.06	7.30	1463	0.04
Terpinen-4-ol	6.78	1173	0.64	8.53*	1557	0.86
para-Cymen-8-ol	6.92	1182	0.07	11.48	1800	0.11
α -Terpineol	7.00*	1188	0.13	9.73*	1653	[0.68]
Myrtenal	7.00*	1188	[0.13]	8.58	1561	0.02
<i>cis</i> -Dihydrocarvone	7.10	1194	0.16	8.43	1550	0.14
Dihydrocarveol	7.16	1198	0.12	10.36*	1705	0.12
<i>trans</i> -Piperitol	7.26	1204	0.05	10.34	1703	0.07
Thymol methyl ether analog I	7.61	1228	0.01	8.36*	1544	1.08
Carvone	7.74	1238	0.02	9.94	1670	0.06
Carvacrol methyl ether	7.83	1244	0.25	8.53*	1557	[0.86]
Geraniol	8.04	1259	0.05	11.59	1809	0.01
Geranial	8.21	1270	0.01	10.05	1679	0.01
Unknown [m/z 119, 79 (94), 91 (0), 84 (80), 93 (68)...]	8.33	1278	0.04			
Bornyl acetate	8.44	1286	0.02	8.19	1531	0.04
Thymol analogue I	8.58	1296	0.04	14.93	2120	0.05
Thymol	8.67*	1302	3.74	15.07	2135	3.66
Thymol analogue II	8.67*	1302	[3.74]	15.22	2150	0.05
Carvacrol	8.92	1315	76.04	15.35*	2163	75.55
2-Methyl-5-(propan-2-ylidene)cyclohexane-1,4-diol ?	8.96	1318	0.10			
2-Methyl-6-propylphenol?	9.06	1325	0.01			
α -Terpinyl acetate	9.36	1346	0.01	9.63	1646	0.01
α -Copaene	9.71*	1371	0.05	7.09	1448	0.02
Carvacryl acetate	9.71*	1371	[0.05]	11.71	1820	0.03
1,5-diepi- β -Bourbonene	9.83*	1380	0.06	7.27	1461	0.04
β -Bourbonene	9.83*	1380	[0.06]	7.42	1472	0.02
Geranyl acetate	9.92	1386	0.02	10.46	1713	0.03
β -Elemene	9.96	1388	0.01	8.36*	1544	[1.08]
Isocaryophyllene	10.13	1400	0.01	8.08*	1522	[0.05]
β -Caryophyllene	10.29*	1412	1.07	8.36*	1544	[1.08]
<i>cis</i> - α -Bergamotene	10.29*	1412	[1.07]	8.14	1527	0.01
β -Copaene	10.43	1423	0.01	8.30*	1540	[0.02]
Aromadendrene	10.56	1432	0.05	8.49	1554	0.03

Selina-5,11-diene	10.62	1437	0.01	8.64	1566	0.05
Unknown [m/z 151, 166 (40), 105 (26)...]	10.74*	1446	0.29			
α -Humulene	10.74*	1446	[0.29]	9.22	1612	0.14
allo-Aromadendrene	10.84	1453	0.04	8.92	1588	0.02
<i>cis</i> -Muurolo-4(15),5-diene	10.87	1456	0.01	9.27	1616	0.03
(<i>E</i>)- β -Farnesene	10.90	1458	0.02	9.44	1630	0.02
<i>trans</i> -Cadina-1(6),4-diene	11.04	1468	0.02	9.19	1609	0.01
γ -Muurolole	11.09	1472	0.05	9.53	1637	0.07
Germacrene D	11.13	1475	0.01	9.69	1650	0.02
allo-Aromadendr-9-ene	11.21	1481	0.02	9.49	1634	0.02
α -Selinene	11.32	1489	0.04	9.84	1662	0.04
α -Muurolole	11.39	1494	0.01	9.98	1673	0.02
(3 <i>Z</i> ,6 <i>E</i>)- α -Farnesene	11.41	1496	0.03	10.21	1692	0.03
β -Bisabolene	11.56*	1507	1.02	10.11	1684	0.95
γ -Cadinene	11.56*	1507	[1.02]	10.29	1699	0.01
Sesquicineole	11.67	1516	0.03	10.24	1695	0.01
<i>trans</i> -Calamenene	11.71*	1519	0.12	11.14	1771	0.02
δ -Cadinene	11.71*	1519	[0.12]	10.36*	1705	[0.12]
β -Sesquiphellandrene	11.73	1520	0.03	10.57	1722	0.03
10- <i>epi</i> -Cubebol?	11.81	1526	0.02	13.69	2000	0.01
α -Calacorene	11.92	1535	0.01	12.03	1848	0.12
(<i>E</i>)- α -Bisabolene	12.00	1541	0.02	10.67	1731	0.02
Spathulenol	12.35	1569	0.03	14.38	2067	0.03
Caryophyllene oxide	12.39*	1572	0.25	12.74	1912	0.22
Caryophyllene oxide isomer	12.39*	1572	[0.25]	12.67	1906	0.01
Humulene epoxide I	12.60	1589	0.01	13.17	1952	0.02
Humulene epoxide II	12.72	1598	0.03	13.34	1968	0.03
10- <i>epi</i> -Cubenol	12.83	1606	0.01	13.62	1994	0.01
Caryophylladienol I	13.03	1623	0.01	15.97	2226	0.01
Caryophylladienol II	13.07	1627	0.02	16.01	2230	0.02
τ -Cadinol	13.15	1633	0.01	14.78	2106	0.02
Unknown [m/z 161, 59 (67), 95 (45), 93 (40), 105 (40), 149 (39), 81 (39), 43 (38), 204 (37)... 220 (5)]	13.32	1647	0.01	14.52	2081	tr
(3 <i>Z</i>)-Caryophylla-3,8(13)-dien-5 β -ol	13.52	1664	0.02	16.77	2310	0.02
α -Bisabolol	13.71	1679	0.01	15.35*	2163	[75.55]
Phytone	15.61	1846	0.01	14.63	2091	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	16.01	1882	0.01			

(39), 150 (22)...						
Unknown [m/z 133, 150 (34), 105 (22), 135 (16), 134 (12)...	16.07	1887	0.01			
Unknown [m/z 81, 150 (83), 136 (81), 135 (67), 93 (48), 121 (36)...	16.14	1893	0.04			
Unknown [m/z 93, 149 (98), 150 (85), 135 (55), 43 (29)...	16.29	1907	0.01			
Unknown [m/z 136, 81 (81), 150 (74), 135 (52), 93 (46), 121 (42)...	16.44	1921	0.09	15.90	2219	0.09
Unknown [m/z 81, 136 (71), 150 (57), 93 (47), 135 (42)...	16.63	1940	0.02			
Unknown [m/z 151, 135 (46), 109 (41), 43 (26), 150 (24), 107 (23)...	16.93	1968	0.02			
Unknown [m/z 135, 150 (66), 43 (38), 109 (27), 93 (25), 137 (20)...	17.46	2020	0.01	18.28	2475	0.01
Unknown [m/z 135, 150 (71), 43 (55), 93 (36), 109 (36), 91 (28)...	18.14	2088	0.01			
Unknown [m/z 69, 41 (81), 91 (37), 166 (35), 105 (33), 43 (30)...	18.46	2120	0.01	19.85	2658	0.01
Unknown [m/z 69, 41 (74), 166 (36), 91 (32), 105 (28), 43 (25)...	18.51	2125	0.03	19.93	2668	0.01
Total identified		98.97%		98.28%		
Total reported		99.37%		98.55%		

*: 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