Date : March 24, 2020

Certificate of Analysis – GC Profiling

Sample identification

Internal code : 20C23-PTH05
Customer identification : Rosemary - Tunisia - R40108910R
Type : Essential oil
Source : *Rosmarinus officinalis* ct. 1,8-Cineole
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 : March 23, 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Notes: This report may not be published, including online, without the written consent from Laboratoire PhytoChemia.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.

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PHYSICOCHEMICAL DATA

Physical aspect: Clear liquid
Refractive index: 1.4668 ± 0.0003 (20 °C)

ISO 1342:2001 - OIL OF ROSEMARY - MOROCCO & TUNISIA

Compound	Min. %	Max. %	Observed %	Complies?
Verbenone		0.4	0	Yes
Borneol	1	5	2	Yes
α-Terpineol	1.0	2.5	1.6	Yes
Bornyl acetate	0.1	1.6	1.0	Yes
Camphor	5	15	11	Yes
para-Cymene	0.5	2.5	1.8	Yes
1,8-Cineole	38	55	44	Yes
Limonene	1.5	4.0	3.7	Yes
Myrcene	1.0	2.0	1.2	Yes
β-Pinene	4	9	8	Yes
Camphene	2.5	6.0	2.7	Yes
α-Pinene	9	14	13	Yes
Refractive index	1.4640	1.4700	1.4668	Yes

CONCLUSION

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

Analysis summary – Consolidated contents

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

Identification	%	Classe
Ethanol	0.01	Aliphatic alcohol
Hashishene	tr	Monoterpene
Tricyclene	0.12	Monoterpene
α-Thujene	0.08	Monoterpene
α-Pinene	13.02	Monoterpene
Camphene	2.75	Monoterpene
α-Fenchene	0.06	Monoterpene
Thuja-2,4(10)-diene	0.03	Monoterpene
β-Pinene	7.76	Monoterpene
Sabinene	0.04	Monoterpene
Octen-3-ol	0.02	Aliphatic alcohol
Myrcene	1.24	Monoterpene
α-Phellandrene	0.33	Monoterpene
Pseudolimonene	0.06	Monoterpene
Δ3-Carene	0.57	Monoterpene
α-Terpinene	0.26	Monoterpene
para-Cymene	1.80	Monoterpene
1,8-Cineole	43.75	Monoterpenic ether
Limonene	3.71	Monoterpene
(*Z*)-β-Ocimene	0.06	Monoterpene
γ-Terpinene	1.28	Monoterpene
cis-Sabinene hydrate	0.02	Monoterpenic alcohol
Octanol	0.01	Aliphatic alcohol
Terpinolene	0.28	Monoterpene
para-Cymenene	0.02	Monoterpene
trans-Sabinene hydrate	0.01	Monoterpenic alcohol
Linalool	0.65	Monoterpenic alcohol
Unknown	0.02	Unknown
endo-Fenchol	0.02	Monoterpenic alcohol
trans-para-Mentha-2,8-dien-1-ol	tr	Monoterpenic alcohol
cis-para-Menth-2-en-1-ol	0.01	Monoterpenic alcohol
trans-para-Menth-2-en-1-ol	0.01	Monoterpenic alcohol
Camphor	11.39	Monoterpenic ketone
Camphene hydrate	0.04	Monoterpenic alcohol
Isoborneol	0.03	Monoterpenic alcohol
Pinocarvone	0.01	Monoterpenic ketone
Borneol	1.71	Monoterpenic alcohol
δ-Terpineol	0.06	Monoterpenic alcohol
Isopinocamphone	0.01	Monoterpenic ketone
Terpinen-4-ol	0.56	Monoterpenic alcohol
α-Terpineol	1.61	Monoterpenic alcohol
Myrtenal	0.01	Monoterpenic aldehyde
Myrtenol	0.02	Monoterpenic alcohol
Verbenone	0.05	Monoterpenic ketone
Bornyl acetate	1.04	Monoterpenic ester
α-Ylangene	0.01	Sesquiterpene
α-Copaene	0.06	Sesquiterpene

Longifolene	tr	Sesquiterpene
Methyleugenol	0.02	Phenylpropanoid
β-Caryophyllene	4.24	Sesquiterpene
β-Copaene	0.03	Sesquiterpene
trans-α-Bergamotene	0.02	Sesquiterpene
α-Humulene	0.17	Sesquiterpene
allo-Aromadendrene	0.01	Sesquiterpene
γ-Muurolene	0.02	Sesquiterpene
β-Selinene	tr	Sesquiterpene
α-Selinene	0.03	Sesquiterpene
α-Muurolene	0.01	Sesquiterpene
γ-Cadinene	0.03	Sesquiterpene
δ-Cadinene	0.04	Sesquiterpene
trans-Cadina-1,4-diene	0.01	Sesquiterpene
Unknown	tr	Sesquiterpene
Caryophyllene oxide	0.04	Sesquiterpenic ether
Consolidated total	**99.32%**	

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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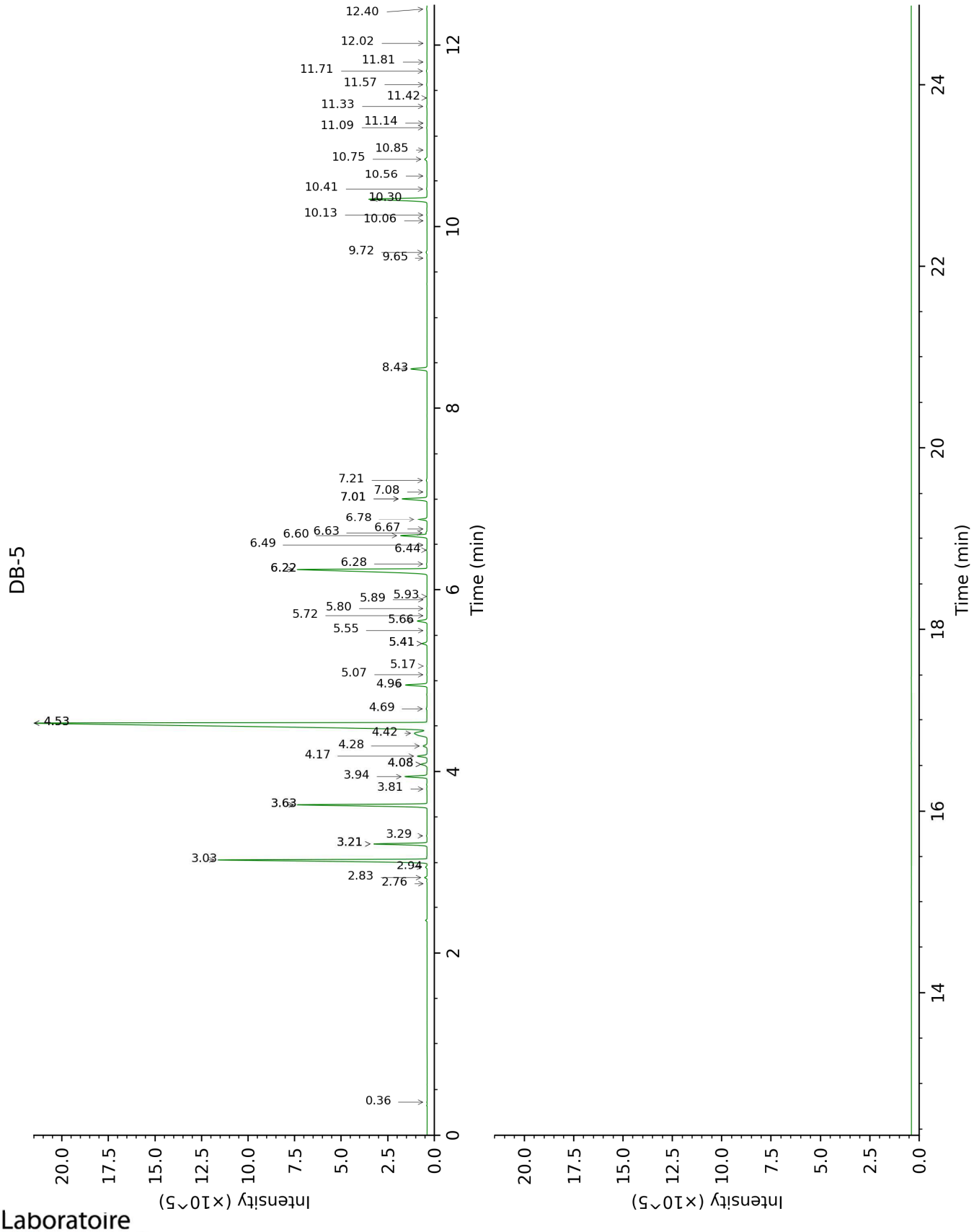

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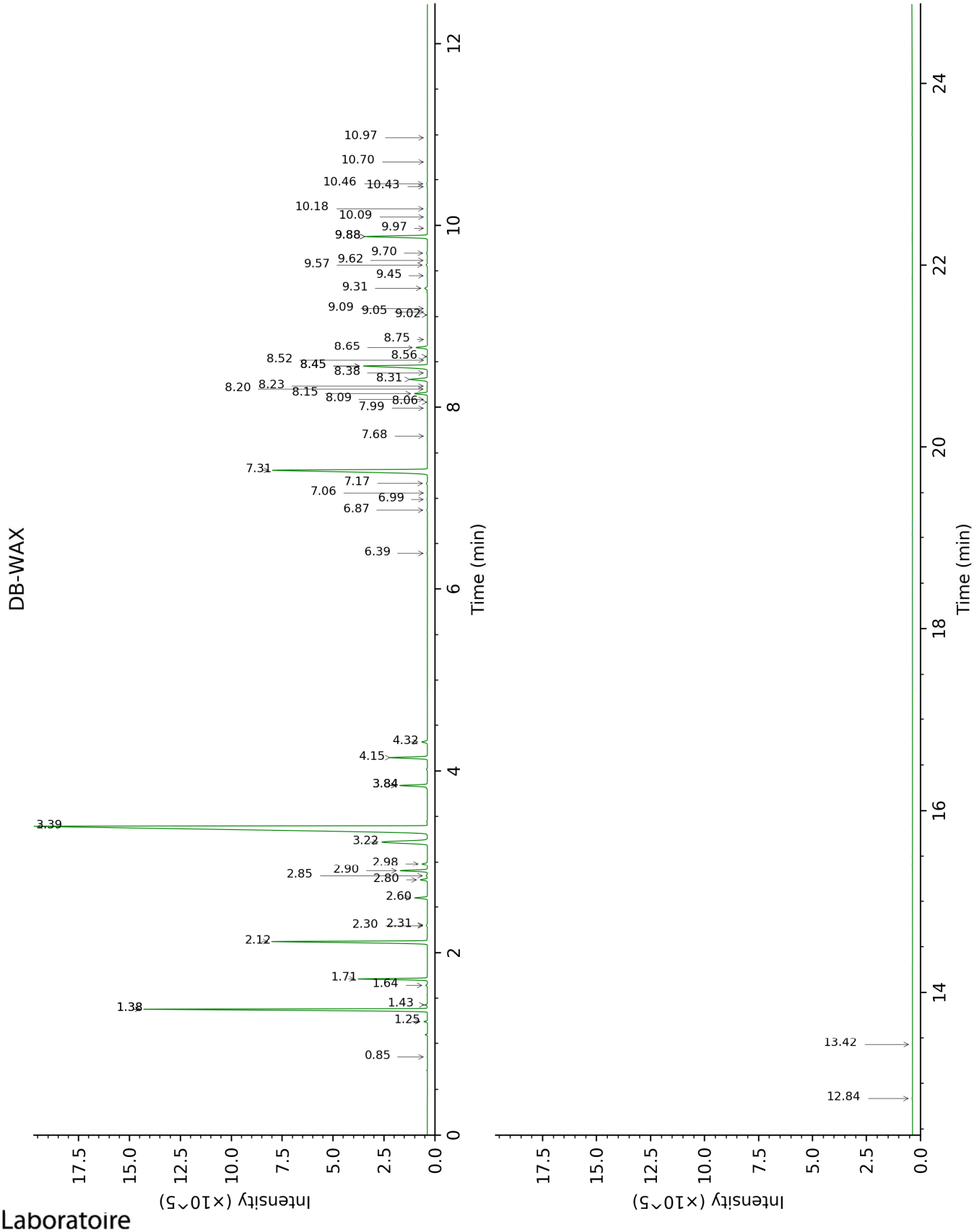
DB-WAX
Time (min)
Intensity (×10^5)
10.97
10.70
10.46
10.43
10.18
10.09
9.97
9.88
9.70
9.57
9.62
9.45
9.31
9.09
9.05
9.02
8.75
8.65
8.56
8.52
8.45
8.38
8.31
8.20
8.23
8.15
8.09
8.06
7.99
7.68
7.31
7.17
7.06
6.99
6.87
6.39
4.32
4.15
3.84
3.39
3.22
2.98
2.90
2.85
2.80
2.60
2.30
2.31
2.12
1.71
1.64
1.43
1.38
1.25
0.85
13.42
12.84

FULL ANALYSIS DATA

Identification	Column DB-5			Column DB-WAX		
	R.T	R.I	%	R.T	R.I	%
Ethanol	0.36	522	0.01	0.85	908	0.01
Hashishene	2.76	913	tr	1.38*	995	12.94
Tricyclene	2.83	918	0.12	1.25	973	0.13
α-Thujene	2.94	925	0.08	1.43	1000	0.10
α-Pinene	3.03	931	13.02	1.38*	995	[12.94]
Camphene	3.21*	943	2.83	1.71	1028	2.75
α-Fenchene	3.21*	943	[2.83]	1.64	1021	0.06
Thuja-2,4(10)-diene	3.30	948	0.03	2.31	1086	0.03
β-Pinene	3.64*	971	7.87	2.12	1068	7.76
Sabinene	3.64*	971	[7.87]	2.30	1085	0.04
Octen-3-ol	3.81	982	0.02	6.87	1424	0.04
Myrcene	3.94	992	1.24	2.90	1134	1.26
α-Phellandrene	4.08*	1000	0.40	2.80	1126	0.33
Pseudolimonene	4.08*	1000	[0.40]	2.84	1129	0.06
Δ3-Carene	4.17	1006	0.57	2.60	1111	0.56
α-Terpinene	4.28	1013	0.26	2.98	1140	0.27
para-Cymene	4.42	1022	1.80	4.15	1227	1.80
1,8-Cineole	4.53*	1029	47.59	3.39	1172	43.75
Limonene	4.53*	1029	[47.59]	3.22	1159	3.71
(*Z*)-β-Ocimene	4.69	1039	0.06	3.84*	1206	1.34
γ-Terpinene	4.96	1056	1.28	3.84*	1206	[1.34]
cis-Sabinene hydrate	5.07	1063	0.02	6.99	1432	0.03
Octanol	5.16	1069	0.01	8.23	1525	0.02
Terpinolene	5.41*	1085	0.31	4.32	1240	0.28
para-Cymenene	5.41*	1085	[0.31]	6.39	1388	0.02
trans-Sabinene hydrate	5.55	1094	0.01	8.09	1514	0.01
Linalool	5.66	1101	0.65	8.15	1519	0.67
Unknown [m/z 139, 95 (95), 109 (64), 121 (40), 41 (23), 136 (22)...]	5.72	1104	0.02			
endo-Fenchol	5.80	1110	0.02	8.45*	1542	4.21
trans-para-Mentha-2,8-dien-1-ol	5.89	1116	tr	9.05	1588	0.01
cis-para-Menth-2-en-1-ol	5.93	1118	0.01	8.20	1523	0.03
trans-para-Menth-2-en-1-ol	6.22*	1137	11.42	9.02	1586	0.01
Camphor	6.22*	1137	[11.42]	7.31	1456	11.39
Camphene hydrate	6.28	1141	0.04	8.56	1550	0.03
Isoborneol	6.44	1151	0.03	9.45	1620	0.02
Pinocarvone	6.49	1155	0.01	8.06	1512	0.01
Borneol	6.60	1162	1.71	9.88*	1655	3.35

δ-Terpineol	6.63	1164	0.06	9.57	1630	0.07
Isopinocamphone	6.67	1166	0.01	7.68	1483	0.01
Terpinen-4-ol	6.78	1174	0.56	8.66	1558	0.60
α-Terpineol	7.01*	1189	1.62	9.88*	1655	[3.35]
Myrtenal	7.01*	1189	[1.62]	8.75	1565	0.01
Myrtenol	7.08	1194	0.02	10.97	1745	0.01
Verbenone	7.21	1202	0.05	9.70	1640	0.06
Bornyl acetate	8.43	1287	1.04	8.31	1531	1.03
α-Ylangene	9.66	1368	0.01	7.06	1437	0.01
α-Copaene	9.72	1372	0.06	7.17	1445	0.07
Longifolene	10.06	1396	tr	7.99	1507	0.02
Methyleugenol	10.13	1401	0.02	13.42	1962	0.01
β-Caryophyllene	10.30	1414	4.24	8.45*	1542	[4.21]
β-Copaene	10.41	1422	0.03	8.38	1536	0.02
trans-α-Bergamotene	10.56	1432	0.02	8.52	1547	0.01
α-Humulene	10.75	1447	0.17	9.31	1609	0.16
allo-Aromadendrene	10.85	1454	0.01	9.09	1591	0.01
γ-Muurolene	11.09	1473	0.02	9.62	1634	0.03
β-Selinene	11.14	1476	tr	9.97	1662	0.01
α-Selinene	11.33	1490	0.03	10.18	1679	0.02
α-Muurolene	11.42	1497	0.01	10.09	1672	0.02
γ-Cadinene	11.57	1508	0.03	10.46	1702	0.04
δ-Cadinene	11.71	1520	0.04	10.43	1699	0.02
trans-Cadina-1,4-diene	11.81	1527	0.01	10.70	1723	0.01
Unknown [m/z 148, 133 (86), 107 (67), 93 (58), 95 (51), 91 (51)... 204 (7)]	12.02	1544	tr			
Caryophyllene oxide	12.40	1573	0.04	12.84	1908	0.03
Total identified		**99.57%**			**99.33%**	
Total reported		**99.59%**			**99.33%**	

*: 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