Date : June 13, 2019

Certificate of Analysis – GC Profiling

Sample identification

Internal code : 19E31-PTH01-1-SCC
Customer identification : Rosemary Org - Tunisia - R5010687R
Type : Essential oil
Source : *Rosmarinus officinalis* ct. 1,8-Cineole
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 : June 13, 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Notes: This report may not be published, including online, without the written consent from Laboratoire PhytoChemia.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.

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PHYSICOCHEMICAL DATA

Physical aspect: Fainlty yellow 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	1.9	Yes
Bornyl acetate	0.1	1.6	0.7	Yes
Camphor	5	15	10	Yes
para-Cymene	0.5	2.5	1.3	Yes
1,8-Cineole	38	55	46.0	Yes
Limonene	1.5	4.0	2.3	Yes
Myrcene	1.0	2.0	1.3	Yes
β-Pinene	4	9	6	Yes
Camphene	2.5	6.0	4.1	Yes
α-Pinene	9	14	12	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
Isovaleral	tr	Aliphatic aldehyde
2-Methylbutyral	0.01	Aliphatic aldehyde
Hexanal	tr	Aliphatic aldehyde
(3*Z*)-Hexenol	0.02	Aliphatic alcohol
Hexanol	0.01	Aliphatic alcohol
Hashishene	0.02	Monoterpene
Tricyclene	0.15	Monoterpene
α-Thujene	0.21	Monoterpene
α-Pinene	11.72	Monoterpene
α-Fenchene	0.09	Monoterpene
Camphene	4.14	Monoterpene
Thuja-2,4(10)-diene	0.02	Monoterpene
Sabinene	0.10	Monoterpene
β-Pinene	5.91	Monoterpene
Octen-3-ol	0.11	Aliphatic alcohol
Octan-3-one	0.07	Aliphatic ketone
Myrcene	1.28	Monoterpene
α-Phellandrene	0.18	Monoterpene
Δ3-Carene	0.17	Monoterpene
α-Terpinene	0.41	Monoterpene
para-Cymene	1.34	Monoterpene
Limonene	2.30	Monoterpene
1,8-Cineole	45.98*	Monoterpenic ether
β-Phellandrene	[45.98]*	Monoterpene
(*Z*)-β-Ocimene	0.04	Monoterpene
(*E*)-β-Ocimene	0.03	Monoterpene
γ-Terpinene	0.62	Monoterpene
cis-Sabinene hydrate	0.10	Monoterpenic alcohol
cis-Linalool oxide (fur.)	0.01	Monoterpenic alcohol
Octanol	0.01	Aliphatic alcohol
Terpinolene	0.30	Monoterpene
para-Cymenene	0.04	Monoterpene
trans-Sabinene hydrate	0.04	Monoterpenic alcohol
Linalool	0.76	Monoterpenic alcohol
endo-Fenchol	0.06	Monoterpenic alcohol
cis-para-Menth-2-en-1-ol	0.01	Monoterpenic alcohol
Camphor	10.04	Monoterpenic ketone
Camphene hydrate	0.07	Monoterpenic alcohol
Isoborneol	0.02	Monoterpenic alcohol
Pinocarvone	0.01	Monoterpenic ketone
Borneol	2.39	Monoterpenic alcohol
δ-Terpineol	0.37	Monoterpenic alcohol
Terpinen-4-ol	0.72	Monoterpenic alcohol
para-Cymen-8-ol	0.03	Monoterpenic alcohol
α-Terpineol	1.88	Monoterpenic alcohol
Myrtenol	0.03	Monoterpenic alcohol
Verbenone	0.02	Monoterpenic ketone

trans-Carveol	0.01	Monoterpenic alcohol
Bornyl formate	0.01	Monoterpenic ester
Carvone	0.01	Monoterpenic ketone
cis-Myrtanol	0.01	Monoterpenic alcohol
trans-Ascaridole glycol	0.02	Monoterpenic alcohol
Bornyl acetate	0.71	Monoterpenic ester
α-Cubebene	0.03	Sesquiterpene
α-Ylangene	0.07	Sesquiterpene
α-Copaene	0.23	Sesquiterpene
Methyleugenol	0.15	Phenylpropanoid
β-Caryophyllene	3.91	Sesquiterpene
β-Copaene	0.10	Sesquiterpene
Aromadendrene	0.05	Sesquiterpene
α-Humulene	0.45	Sesquiterpene
allo-Aromadendrene	0.04	Sesquiterpene
trans-Cadina-1(6),4-diene	0.02	Sesquiterpene
γ-Muurolene	0.19	Sesquiterpene
β-Selinene	0.06	Sesquiterpene
α-Muurolene	0.05	Sesquiterpene
β-Bisabolene	0.07	Sesquiterpene
γ-Cadinene	0.12	Sesquiterpene
δ-Cadinene	0.30	Sesquiterpene
Caryophyllene oxide	0.12	Sesquiterpenic ether
Caryophyllene oxide isomer	0.01	Sesquiterpenic ether
Humulene epoxide II	0.02	Sesquiterpenic ether
Unknown	0.01	Oxygenated sesquiterpene
Caryophylladienol II	0.02	Sesquiterpenic alcohol
14-Hydroxy-(*Z*)-caryophyllene	0.04	Sesquiterpenic alcohol
14-Hydroxy-(*E*)-caryophyllene	0.01	Sesquiterpenic alcohol
meta-Camphorene	0.01	Diterpene
Consolidated total	**98.74%**	

*: 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.

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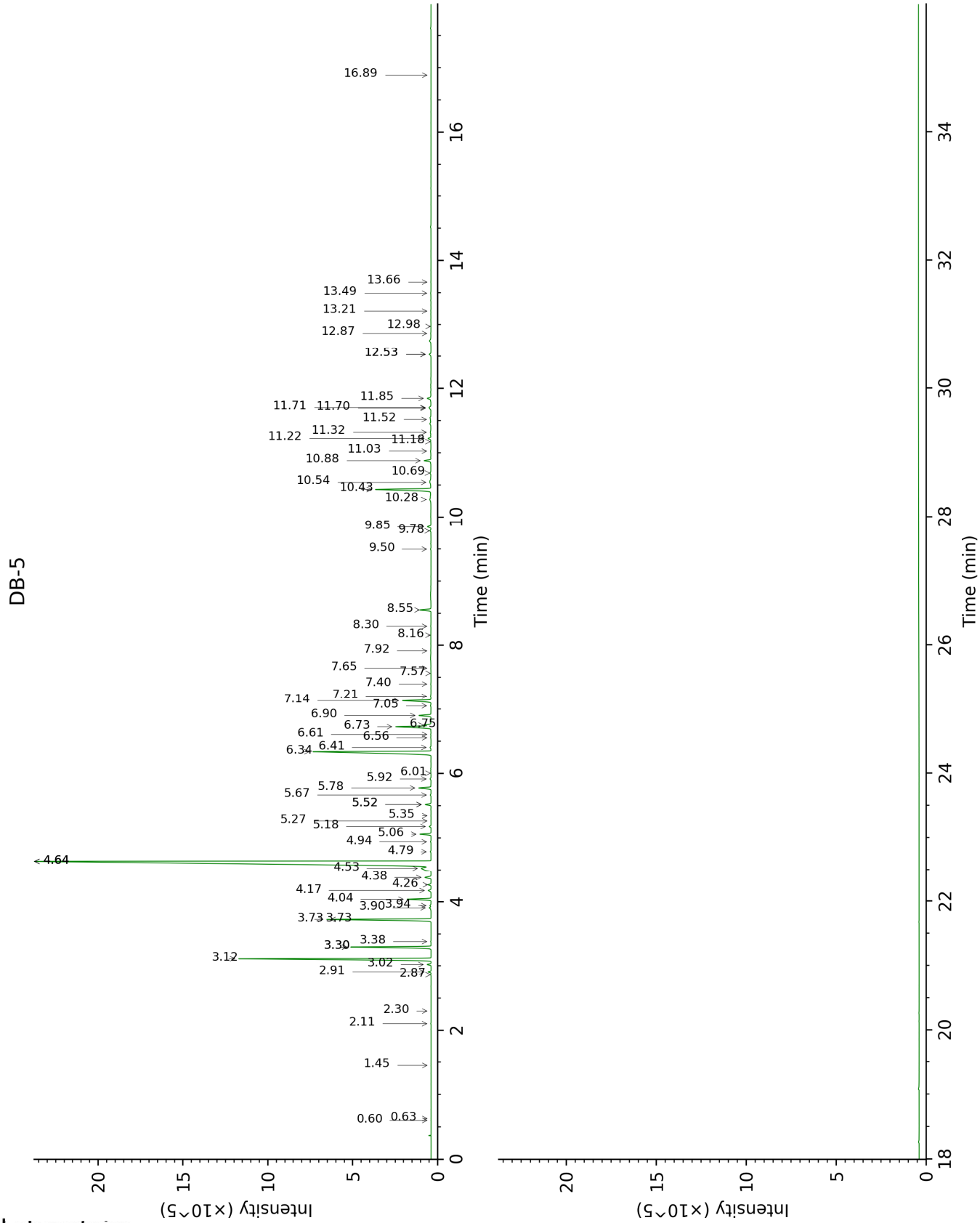
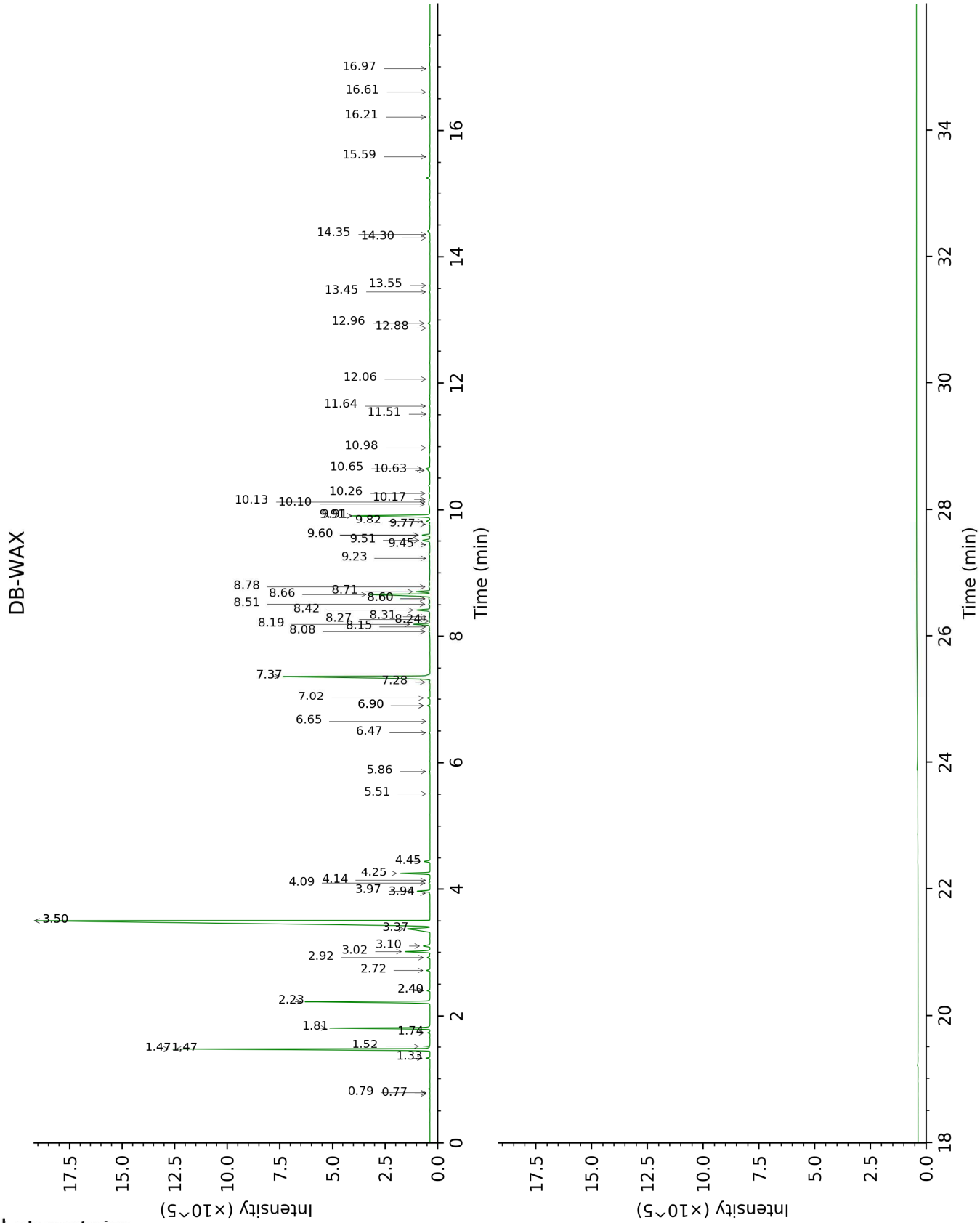

DB-5
16.89
13.66
13.49
13.21
12.98
12.87
12.53
11.85
11.71
11.70
11.52
11.32
11.22
11.18
11.03
10.88
10.69
10.54
10.43
10.28
9.85
9.78
9.50
8.55
8.30
8.16
7.92
7.65
7.57
7.40
7.21
7.14
7.05
6.90
6.75
6.73
6.61
6.56
6.41
6.34
6.01
5.92
5.78
5.67
5.52
5.35
5.27
5.18
5.06
4.94
4.79
4.64
4.53
4.38
4.26
4.17
4.04
3.94
3.90
3.73
3.38
3.30
3.12
3.02
2.91
2.87
2.30
2.11
1.45
0.63
0.60
Time (min)
Intensity (×10^5)


DB-WAX
Time (min)
Intensity (×10^5)
16.97
16.61
16.21
15.59
14.35
14.30
13.45
13.55
12.96
12.88
12.06
11.64
11.51
10.98
10.65
10.63
10.26
10.17
10.13
10.10
9.82
9.77
9.60
9.51
9.45
9.23
8.78
8.66
8.71
8.60
8.51
8.42
8.27
8.31
8.24
8.19
8.08
8.15
7.37
7.28
7.02
6.90
6.65
6.47
5.86
5.51
4.45
4.25
4.09
4.14
3.97
3.94
3.50
3.37
3.10
2.92
3.02
2.72
2.40
2.23
1.81
1.74
1.47
1.52
1.33
0.79
0.77

FULL ANALYSIS DATA

Identification	Column DB-5			Column DB-WAX		
	R.T	R.I	%	R.T	R.I	%
Isovaleral	0.60	638	tr	0.79	886	tr
2-Methylbutyral	0.63	649	0.01	0.77	880	tr
Hexanal	1.45	799	tr			
(3*Z*)-Hexenol	2.11	855	0.02	5.86	1340	0.02
Hexanol	2.30	871	0.01	5.51	1315	0.01
Hashishene	2.87	914	0.02	1.47*	997	11.67
Tricyclene	2.91	917	0.15	1.33	975	0.15
α-Thujene	3.02	924	0.21	1.52	1002	0.22
α-Pinene	3.12	930	11.72	1.47*	997	[11.67]
α-Fenchene	3.30*	942	4.25	1.74	1023	0.09
Camphene	3.30*	942	[4.25]	1.81	1030	4.14
Thuja-2,4(10)-diene	3.38	948	0.02	2.40*	1086	0.12
Sabinene	3.73*	970	6.02	2.40*	1086	[0.12]
β-Pinene	3.73*	970	[6.02]	2.23	1070	5.91
Octen-3-ol	3.90	982	0.11	6.90*	1416	0.13
Octan-3-one	3.94	984	0.07	4.10	1220	0.05
Myrcene	4.04	991	1.28	3.02	1136	1.29
α-Phellandrene	4.18	1000	0.18	2.92	1129	0.15
Δ3-Carene	4.26	1005	0.17	2.72	1113	0.17
α-Terpinene	4.38	1012	0.41	3.10	1143	0.41
para-Cymene	4.53	1022	1.34	4.25	1231	1.42
Limonene	4.64*	1029	48.28	3.37	1164	2.30
1,8-Cineole	4.64*	1029	[48.28]	3.50*	1174	45.95
β-Phellandrene	4.64*	1029	[48.28]	3.50*	1174	[45.95]
(*Z*)-β-Ocimene	4.79	1038	0.04	3.94	1208	0.04
(*E*)-β-Ocimene	4.94	1048	0.03	4.14	1223	0.03
γ-Terpinene	5.06	1055	0.62	3.97	1210	0.62
cis-Sabinene hydrate	5.18	1062	0.10	7.02	1425	0.14
cis-Linalool oxide (fur.)	5.27	1068	0.01	6.65	1398	0.01
Octanol	5.35	1073	0.01	8.31	1523	tr
Terpinolene	5.52*	1084	0.34	4.45	1246	0.30
para-Cymenene	5.52*	1084	[0.34]	6.47	1384	0.04
trans-Sabinene hydrate	5.67	1093	0.04	8.08	1505	0.04
Linalool	5.78	1100	0.76	8.19	1514	0.78
endo-Fenchol	5.92	1109	0.06	8.51	1538	0.06
cis-para-Menth-2-en-1-ol	6.01	1115	0.01	8.24	1518	0.02
Camphor	6.34	1136	10.04	7.37*	1451	10.28
Camphene hydrate	6.41	1141	0.07	8.60*†	1545	3.92
Isoborneol	6.56	1150	0.02	9.60*	1624	0.40
Pinocarvone	6.61	1154	0.01	8.15	1510	0.01
Borneol	6.73	1162	2.39	9.91*	1650	4.28
δ-Terpineol	6.76	1163	0.37	9.60*	1624	[0.40]

Terpinen-4-ol	6.90	1173	0.72	8.71	1554	0.70
para-Cymen-8-ol	7.06	1182	0.03	11.64	1795	0.03
α-Terpineol	7.14	1188	1.88	9.91*	1650	[4.28]
Myrtenol	7.21	1192	0.03	10.98	1739	0.02
Verbenone	7.40	1205	0.02	9.76	1638	0.03
trans-Carveol	7.57	1216	0.01	11.51	1784	0.01
Bornyl formate	7.65	1222	0.01	8.27	1520	0.02
Carvone	7.92	1240	0.01	10.13	1668	0.07
cis-Myrtanol	8.16	1257	0.01	12.06	1832	0.01
trans-Ascaridole glycol	8.30	1266	0.02	14.35	2043	0.01
Bornyl acetate	8.55	1284	0.71	8.42	1531	0.74
α-Cubebene	9.50	1345	0.03	6.90*	1416	[0.13]
α-Ylangene	9.78	1365	0.07	7.28	1445	0.07
α-Copaene	9.85	1369	0.23	7.37*	1451	[10.28]
Methyleugenol	10.28	1400	0.15	13.45	1958	0.04
β-Caryophyllene	10.43	1411	3.91	8.66†	1550	[3.92]
β-Copaene	10.54	1419	0.10	8.60*†	1545	[3.92]
Aromadendrene	10.69	1430	0.05	8.78	1560	0.07
α-Humulene	10.88	1444	0.45	9.51	1618	0.47
allo-Aromadendrene	11.03	1455	0.04	9.23	1595	0.05
trans-Cadina-1(6),4-diene	11.18	1466	0.02	9.44	1612	0.01
γ-Muurolene	11.22	1470	0.19	9.82	1643	0.20
β-Selinene	11.32	1477	0.06	10.10	1665	0.14
α-Muurolene	11.52	1492	0.05	10.17	1671	0.06
β-Bisabolene	11.70	1505	0.07	10.26	1679	0.09
γ-Cadinene	11.71	1506	0.12	10.63	1709	0.10
δ-Cadinene	11.85	1517	0.30	10.65	1711	0.26
Caryophyllene oxide	12.53*	1570	0.14	12.96	1912	0.12
Caryophyllene oxide isomer	12.53*	1570	[0.14]	12.88	1905	0.01
Humulene epoxide II	12.87	1596	0.02	13.55	1967	0.02
Unknown [m/z 94, 91 (83), 105 (78), 79 (75), 107 (62), 120 (58)... 218 (11)]	12.98	1605	0.01	14.30	2038	0.01
Caryophylladienol II	13.21	1624	0.02	16.21	2228	0.02
14-Hydroxy-(*Z*)-caryophyllene	13.49	1647	0.04	16.61	2268	0.02
14-Hydroxy-(*E*)-caryophyllene	13.66	1661	0.01	16.97	2307	0.01
meta-Camphorene	16.89	1946	0.01	15.59	2164	0.01
Total identified		**98.75%**			**98.58%**	
Total reported		**98.76%**			**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

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