Date : June 11, 2019

Certificate of Analysis – GC Profiling

Sample identification

Internal code : 19F10-PTH10-1-SCC
Customer identification : Star Anise - China - A2010385R
Type : Essential oil
Source : *Illicium verum*
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 : Alexis St-Gelais, M. Sc., chimiste
Analysis date : June 11, 2019

Checked and approved by :

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

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PHYSICOCHEMICAL DATA

Physical aspect: Clear liquid
Refractive index: 1.5541 ± 0.0003 (20 °C)

ISO 11016:1999 - OIL OF STAR ANISE, CHINESE TYPE

Compound	Min. %	Max. %	Observed %	Complies?
(E)-Foeniculin	0.1	3.0	1.0	Yes
cis-α-Bergamotene	0.04	0.09	0.08	Yes
trans-α-Bergamotene	0.06	0.60	0.38	Yes
β-Caryophyllene		0.8	0.3	Yes
(E)-Anethole	86.0	93.0	88.0	Yes
para-Anisaldehyde	0.1	0.5	0.4	Yes
(Z)-Anethole	0.1	1.0	0.6	Yes
Methylchavicol	0.6	6.0	3.3	Yes
α-Terpineol		0.3	0.1	Yes
Linalool	0.2	2.5	1.1	Yes
Limonene	0.2	6.0	0.9	Yes
α-Phellandrene		0.7	0.3	Yes
α-Pinene	0.1	1.5	0.4	Yes
Refractive index	1.5530	1.5560	1.5541	Yes

CONCLUSION

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

Analysis summary – Consolidated contents

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

Identification	%	Classe
2-Methyl-3-buten-2-ol	tr	Aliphatic alcohol
Isovaleral	tr	Aliphatic aldehyde
2-Methylbutyral	tr	Aliphatic aldehyde
Hexanal	0.01	Aliphatic aldehyde
Furfural	0.01	Aliphatic alcohol
α-Thujene	0.01	Monoterpene
α-Pinene	0.40	Monoterpene
Camphene	0.01	Monoterpene
Sabinene	0.06	Monoterpene
β-Pinene	0.04	Monoterpene
Myrcene	0.09	Monoterpene
α-Phellandrene	0.25	Monoterpene
Pseudolimonene	0.01	Monoterpene
Δ3-Carene	0.19	Monoterpene
α-Terpinene	0.04	Monoterpene
para-Cymene	0.06	Monoterpene
Limonene	0.90	Monoterpene
1,8-Cineole	0.40*	Monoterpenic ether
β-Phellandrene	[0.40]*	Monoterpene
(*Z*)-β-Ocimene	0.01	Monoterpene
(*E*)-β-Ocimene	0.02	Monoterpene
γ-Terpinene	0.06	Monoterpene
cis-Linalool oxide (fur.)	0.01	Monoterpenic alcohol
para-Cymenene	0.01	Monoterpene
Terpinolene	0.05	Monoterpene
trans-Linalool oxide (fur.)	0.01	Monoterpenic alcohol
Linalool	1.09	Monoterpenic alcohol
trans-Pinocarveol	tr	Monoterpenic alcohol
Borneol	0.01	Monoterpenic alcohol
Terpinen-4-ol	0.12	Monoterpenic alcohol
α-Terpineol	0.09	Monoterpenic alcohol
Methylchavicol	3.30	Phenylpropanoid
para-Anisaldehyde	0.38	Simple phenolic
(*Z*)-Anethole	0.64	Phenylpropanoid
(*E*)-Anethole	88.02	Phenylpropanoid
α-Copaene	0.08	Sesquiterpene
para-Acetonylanisole	0.07	Phenylpropanoid
Methyl para-anisate	0.06	Phenolic ester
β-Elemene	0.02	Sesquiterpene
β-Caryophyllene	0.26	Sesquiterpene
cis-α-Bergamotene	0.08	Sesquiterpene
trans-α-Bergamotene	0.38	Sesquiterpene
cis-β-Bergamotene?	0.01	Sesquiterpene
α-Humulene	0.04	Sesquiterpene
(*E*)-β-Farnesene	0.04	Sesquiterpene
Viridiflorene	0.07	Sesquiterpene
Bicyclogermacrene	0.03	Sesquiterpene

α-Muurolene	0.06	Sesquiterpene
β-Bisabolene	0.07	Sesquiterpene
γ-Cadinene	0.01	Sesquiterpene
(3*E*,6*E*)-α-Farnesene	0.07	Sesquiterpene
δ-Cadinene	0.06	Sesquiterpene
α-Elemol	0.01	Sesquiterpenic alcohol
(*E*)-Nerolidol	0.11	Sesquiterpenic alcohol
1-(4-Methoxyphenyl)propane-1,2-diol isomer I	0.03	Phenylpropanoid
1-(4-Methoxyphenyl)propane-1,2-diol isomer II	0.03	Phenylpropanoid
(*Z*)-Foeniculin	0.04	Phenylpropanoid
Viridiflorol	0.01	Sesquiterpenic alcohol
γ-Eudesmol	0.01	Sesquiterpenic alcohol
τ-Cadinol	0.02	Sesquiterpenic alcohol
τ-Muurolol	0.01	Sesquiterpenic alcohol
β-Eudesmol	0.01	Sesquiterpenic alcohol
α-Eudesmol	0.01	Sesquiterpenic alcohol
α-Cadinol	0.04	Sesquiterpenic alcohol
(*E*)-Foeniculin	1.02	Phenylpropanoid
Unknown	0.01	Phenylpropanoid
Consolidated total	**99.06%**	

*: 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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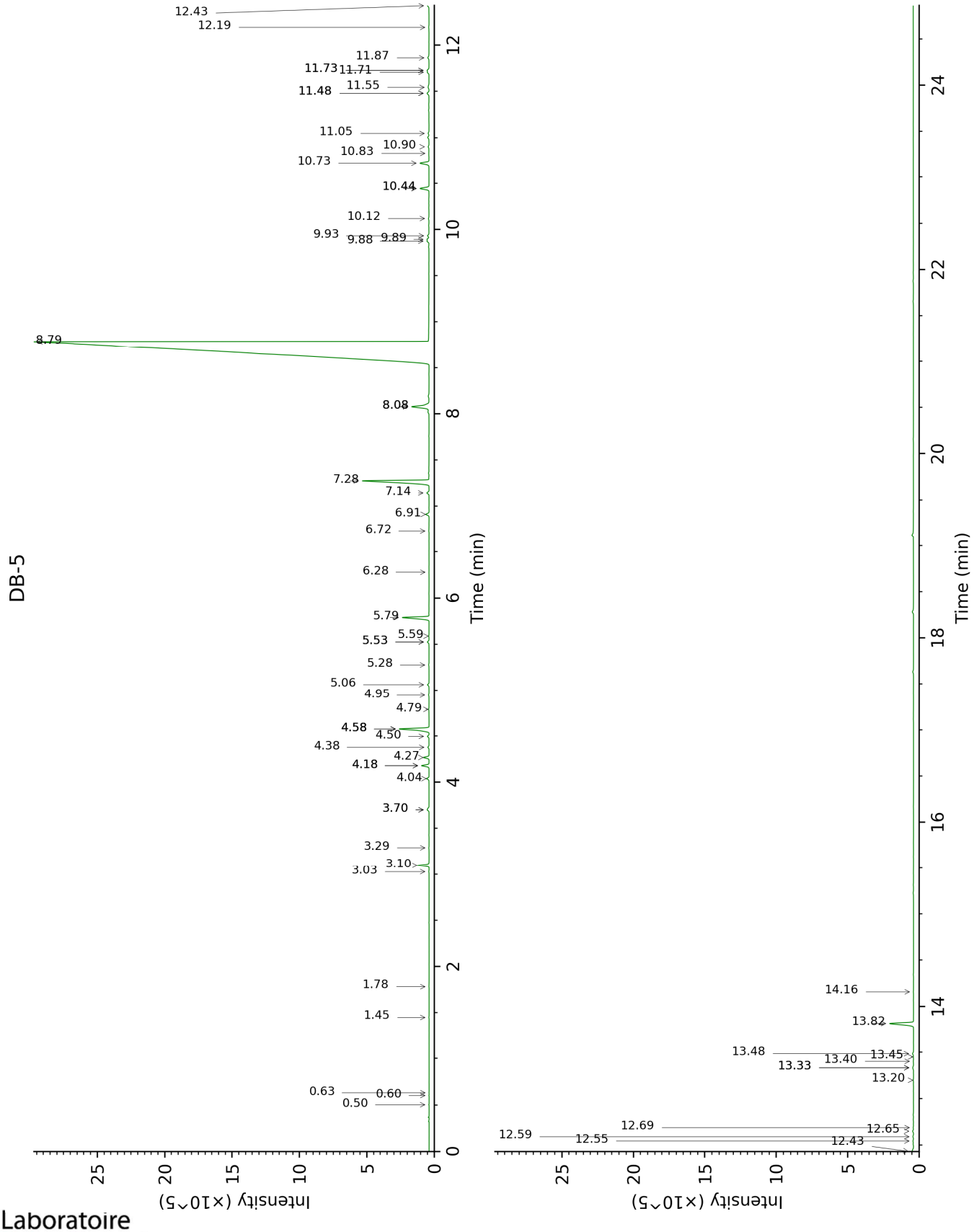
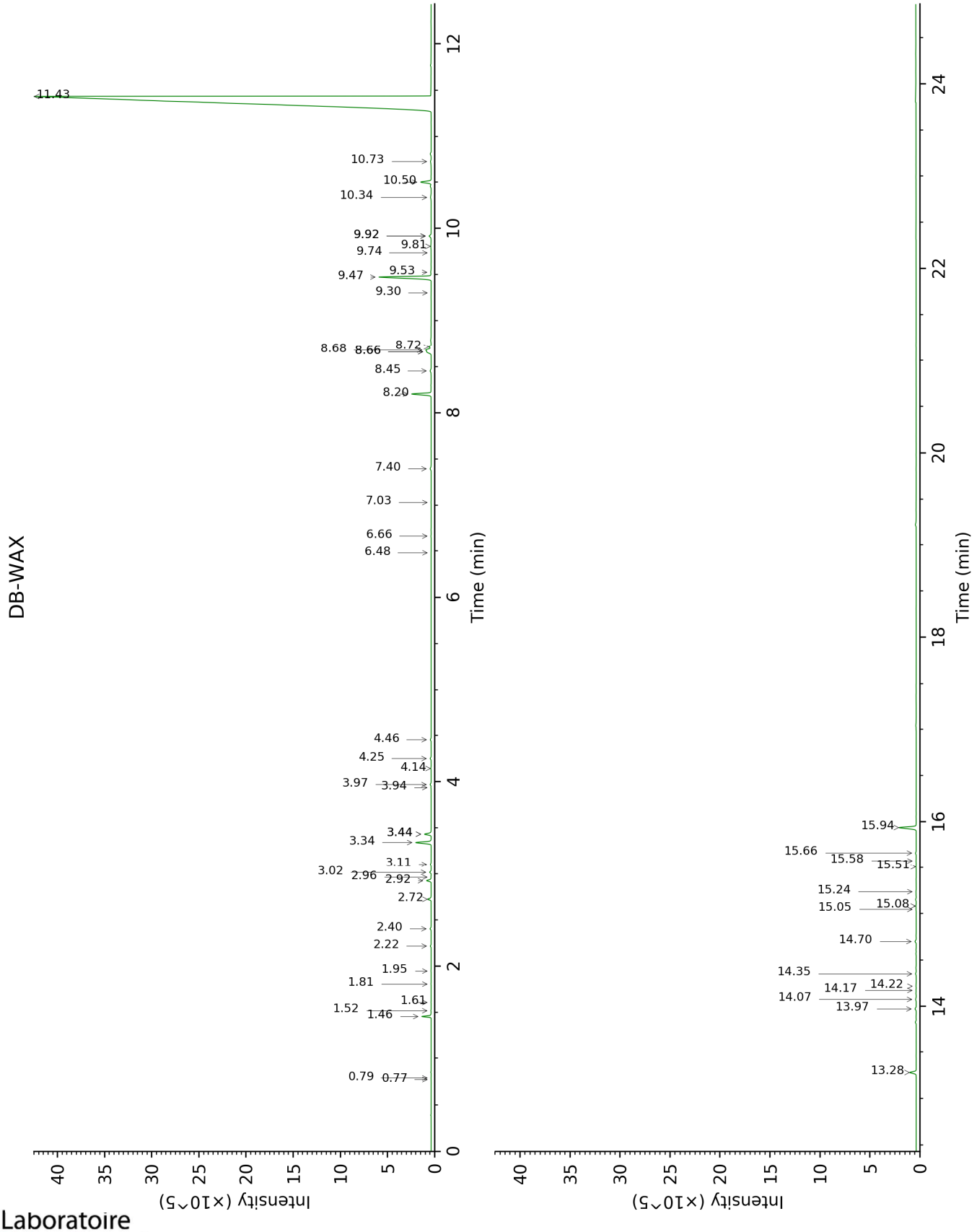

DB-5
12.43
12.19
11.87
11.73
11.71
11.55
11.48
11.05
10.90
10.83
10.73
10.44
10.12
9.93
9.88
9.89
8.79
8.08
7.28
7.14
6.91
6.72
6.28
5.79
5.59
5.53
5.28
5.06
4.95
4.79
4.58
4.50
4.38
4.27
4.18
4.04
3.70
3.29
3.10
3.03
1.78
1.45
0.63
0.60
0.50
Time (min)
Intensity (×10^5)
14.16
13.82
13.48
13.45
13.40
13.33
13.20
12.69
12.65
12.59
12.55
12.43
Time (min)
Intensity (×10^5)


DB-WAX
Intensity (×10^5)
Time (min)
11.43
10.73
10.50
10.34
9.92
9.81
9.74
9.53
9.47
9.30
8.72
8.68
8.66
8.45
8.20
7.40
7.03
6.66
6.48
4.46
4.25
4.14
3.97
3.94
3.44
3.34
3.11
3.02
2.96
2.92
2.72
2.40
2.22
1.95
1.81
1.61
1.52
1.46
0.79
0.77
15.94
15.66
15.58
15.51
15.24
15.08
15.05
14.70
14.35
14.22
14.17
14.07
13.97
13.28

FULL ANALYSIS DATA

Identification	Column DB-5			Column DB-WAX		
	R.T	R.I	%	R.T	R.I	%
2-Methyl-3-buten-2-ol	0.50	590	tr	1.61	1010	0.01
Isovaleral	0.60	638	tr	0.79	887	tr
2-Methylbutyral	0.63	650	tr	0.77	881	tr
Hexanal	1.45	799	0.01	1.95	1043	0.01
Furfural	1.78	828	0.01			
α-Thujene	3.03	924	0.01	1.52	1002	0.01
α-Pinene	3.10	929	0.40	1.46	996	0.39
Camphene	3.29	942	0.01	1.81	1029	0.01
Sabinene	3.70*	969	0.10	2.40	1087	0.06
β-Pinene	3.70*	969	[0.10]	2.22	1069	0.04
Myrcene	4.04	991	0.09	3.02	1136	0.08
α-Phellandrene	4.18*	1000	0.27	2.92	1129	0.25
Pseudolimonene	4.18*	1000	[0.27]	2.96	1132	0.01
Δ3-Carene	4.27	1006	0.19	2.72	1114	0.19
α-Terpinene	4.38	1012	0.04	3.11	1143	0.04
para-Cymene	4.50	1020	0.06	4.25	1231	0.06
Limonene	4.58*	1025	1.29	3.34	1162	0.90
1,8-Cineole	4.58*	1025	[1.29]	3.44*	1169	0.38
β-Phellandrene	4.58*	1025	[1.29]	3.44*	1169	[0.38]
(*Z*)-β-Ocimene	4.79	1038	0.01	3.94	1208	0.01
(*E*)-β-Ocimene	4.95	1048	0.02	4.14	1223	0.02
γ-Terpinene	5.06	1055	0.06	3.97	1211	0.06
cis-Linalool oxide (fur.)	5.28	1069	0.01	6.66	1398	0.01
para-Cymenene	5.53*	1084	0.07	6.48	1385	0.01
Terpinolene	5.53*	1084	[0.07]	4.46	1246	0.05
trans-Linalool oxide (fur.)	5.59	1088	0.01	7.03	1426	0.01
Linalool	5.79	1101	1.09	8.20	1515	1.09
trans-Pinocarveol	6.28	1132	tr	9.30	1601	tr
Borneol	6.72	1161	0.01	9.92*	1651	0.14
Terpinen-4-ol	6.91	1173	0.12	8.72	1554	0.12
α-Terpineol	7.14	1188	0.09	9.92*	1651	[0.14]
Methylchavicol	7.28	1197	3.30	9.48	1614	3.35
para-Anisaldehyde	8.08*	1251	0.95	13.28	1942	0.38
(*Z*)-Anethole	8.08*	1251	[0.95]	10.50	1698	0.64
(*E*)-Anethole	8.79	1300	88.02	11.43	1777	88.30
α-Copaene	9.88	1371	0.08	7.40	1453	0.08
para-Acetonylanisole	9.89	1373	0.07	14.70	2076	0.07
Methyl para-anisate	9.93	1375	0.06	14.08	2016	0.04
β-Elemene	10.12	1388	0.02	8.66*†	1550	0.67
β-Caryophyllene	10.44*	1412	0.38	8.68†	1552	[0.67]
cis-α-Bergamotene	10.44*	1412	[0.38]	8.45	1534	0.08
trans-α-Bergamotene	10.73	1433	0.38	8.66*†	1550	[0.67]
cis-β-Bergamotene?	10.83	1441	0.01			
α-Humulene	10.90	1446	0.04	9.53	1619	0.04
(*E*)-β-Farnesene	11.05	1456	0.04	9.74	1636	0.01
Viridiflorene	11.48*	1489	0.09	9.81	1642	0.07
Bicyclogermacrene	11.48*	1489	[0.09]			
α-Muurolene	11.55	1493	0.06			

β-Bisabolene	11.71	1506	0.07	10.34	1684	0.07
γ-Cadinene	11.73*	1507	0.08			
(3*E*,6*E*)-α-Farnesene	11.73*	1507	[0.08]	10.73	1718	0.07
δ-Cadinene	11.87	1518	0.06			
α-Elemol	12.19	1544	0.01	14.22	2030	0.02
(*E*)-Nerolidol	12.43	1562	0.11	13.97	2006	0.07
1-(4-Methoxyphenyl)propane-1,2-diol isomer I	12.55	1571	0.03			
1-(4-Methoxyphenyl)propane-1,2-diol isomer II	12.59	1575	0.03			
(*Z*)-Foeniculin	12.65	1579	0.04	14.35	2043	0.04
Viridiflorol	12.69	1582	0.01	14.17	2026	0.01
γ-Eudesmol	13.20	1623	0.01	15.05	2110	0.01
τ-Cadinol	13.33*	1634	0.04	15.08	2114	0.02
τ-Muurolol	13.33*	1634	[0.04]	15.24	2129	0.01
β-Eudesmol	13.40	1640	0.01	15.58	2163	0.01
α-Eudesmol	13.45	1644	0.01	15.51	2156	0.01
α-Cadinol	13.48	1646	0.04	15.66	2172	0.04
(*E*)-Foeniculin	13.82	1674	1.02	15.94	2199	1.04
Unknown [m/z 137, 109 (15), 43 (10), 164 (9), 138 (9)...]	14.16	1702	0.01			
Total identified		**99.04%**			**99.14%**	
Total reported		**99.05%**			**99.14%**	

*: 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