Date : April 25, 2022

Certificate of Analysis – GC Profiling

Sample identification

Internal code : 22D14-PTH02
Customer identification : Star Anise - China - A20106R
Type : Essential oil
Source : *Illicium verum*
Customer : Plant Therapy

Analysis

Method: PC-MAT-014 ISO - Analysis of the composition of an essential oil or other volatile liquid by FAST GC-FID (in French); identifications validated by GC-MS.
Analyst : Sylvain Mercier, M. Sc., Chimiste 2014-005
Analysis date : April 25, 2022

Checked and approved by :

Sylvain Mercier, M. Sc., Chimiste 2014-005

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Méthode certifiée ISO 17025:2017 Certified method

Laboratoire PhytoChemia

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PHYSICOCHEMICAL DATA

Physical aspect: Faintly yellow liquid
Refractive index: 1.5543 ± 0.0003 (20 °C; method PC-MAT-016)

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

Compound	Min. %	Max. %	Observed %	Complies?
α-Pinene	0.1	1.5	0.6	Yes
α-Phellandrene		0.7	0.3	Yes
Limonene	0.2	6.0	0.4	Yes
Linalool	0.2	2.5	1.1	Yes
α-Terpineol		0.3	0.1	Yes
Methylchavicol	0.6	6.0	3.1	Yes
(Z)-Anethole	0.1	1.0	0.2	Yes
para-Anisaldehyde	0.1	0.5	0.6	No
(E)-Anethole	86.0	93.0	88.7	Yes
β-Caryophyllene		0.8	0.3	Yes
trans-α-Bergamotene	0.06	0.60	0.38	Yes
cis-α-Bergamotene	0.04	0.09	0.06	Yes
(E)-Foeniculin	0.1	3.0	1.0	Yes
Refractive index	1.5530	1.5560	1.5543	Yes

CONCLUSION

No adulterant, contaminant or diluent has been detected using this method. The oil marginally does not comply 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	%	Class
Ethanol	0.01	Aliphatic alcohol
2-Methyl-3-buten-2-ol	0.01	Aliphatic alcohol
Isovaleral	tr	Aliphatic aldehyde
2-Methylbutyral	tr	Aliphatic aldehyde
Hexanal	tr	Aliphatic aldehyde
α-Thujene	0.01	Monoterpene
α-Pinene	0.56	Monoterpene
Camphene	0.02	Monoterpene
β-Pinene	0.05	Monoterpene
Sabinene	0.05	Monoterpene
Myrcene	0.08	Monoterpene
α-Phellandrene	0.30	Monoterpene
Pseudolimonene	0.01	Monoterpene
Δ3-Carene	0.14	Monoterpene
α-Terpinene	0.04	Monoterpene
para-Cymene	0.09	Monoterpene
Limonene	0.37	Monoterpene
β-Phellandrene	0.22	Monoterpene
1,8-Cineole	0.15	Monoterpenic ether
(*Z*)-β-Ocimene	0.01	Monoterpene
(*E*)-β-Ocimene	0.01	Monoterpene
γ-Terpinene	0.05	Monoterpene
cis-Linalool oxide (fur.)	0.02	Monoterpenic alcohol
Terpinolene	0.05	Monoterpene
trans-Linalool oxide (fur.)	0.01	Monoterpenic alcohol
Methyl benzoate	0.01	Phenolic ester
Linalool	1.14	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	3.13	Phenylpropanoid
Dihydroanethole	0.06	Phenylpropanoid
(*Z*)-Anethole	0.18	Phenylpropanoid
para-Anisaldehyde	0.65	Simple phenolic
(*E*)-Anethole	88.67	Phenylpropanoid
α-Copaene	0.08	Sesquiterpene
Unknown	0.09	Phenylpropanoid
Methyl para-anisate	0.03	Phenolic ester
para-Acetonylanisole	0.13	Phenylpropanoid
β-Elemene	0.03	Sesquiterpene
β-Caryophyllene	0.35	Sesquiterpene
cis-α-Bergamotene	0.06	Sesquiterpene
trans-α-Bergamotene	0.38	Sesquiterpene
Aromadendrene	0.03	Sesquiterpene

α-Humulene	0.04	Sesquiterpene
Methyl (*Z*)-isoeugenol	0.06	Phenylpropanoid
(*E*)-β-Farnesene	0.04	Sesquiterpene
Bicyclogermacrene	0.04	Sesquiterpene
Viridiflorene	0.05	Sesquiterpene
α-Muurolene	0.05	Sesquiterpene
β-Bisabolene	0.08	Sesquiterpene
γ-Cadinene	0.01	Sesquiterpene
δ-Cadinene	0.07	Sesquiterpene
trans-Calamenene	0.01	Sesquiterpene
α-Elemol	0.01	Sesquiterpenic alcohol
(*E*)-Nerolidol	0.08	Sesquiterpenic alcohol
1-(4-Methoxyphenyl)propane-1,2-diol isomer I	0.04	Phenylpropanoid
1-(4-Methoxyphenyl)propane-1,2-diol isomer II	0.06	Phenylpropanoid
Viridiflorol	0.03	Sesquiterpenic alcohol
(*Z*)-Foeniculin	0.01	Phenylpropanoid
γ-Eudesmol	0.01	Sesquiterpenic alcohol
τ-Cadinol	0.04	Sesquiterpenic alcohol
β-Eudesmol	0.02	Sesquiterpenic alcohol
α-Muurolol	0.01	Sesquiterpenic alcohol
α-Eudesmol	0.01	Sesquiterpenic alcohol
α-Cadinol	0.06	Sesquiterpenic alcohol
(*E*)-Foeniculin	1.05	Phenylpropanoid
(2*E*,6*E*)-Farnesol	0.01	Sesquiterpenic alcohol
Consolidated total	**99.40%**	

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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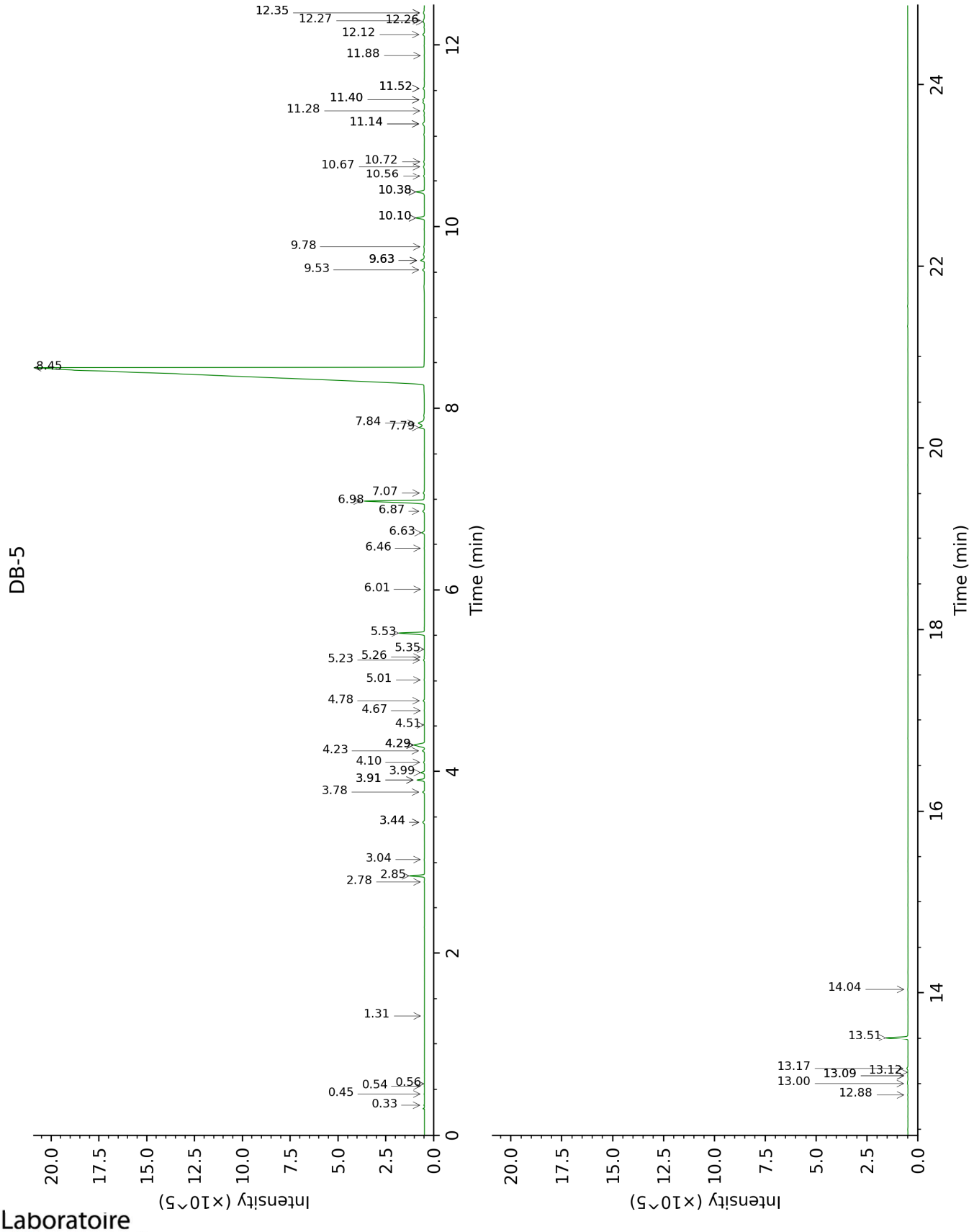
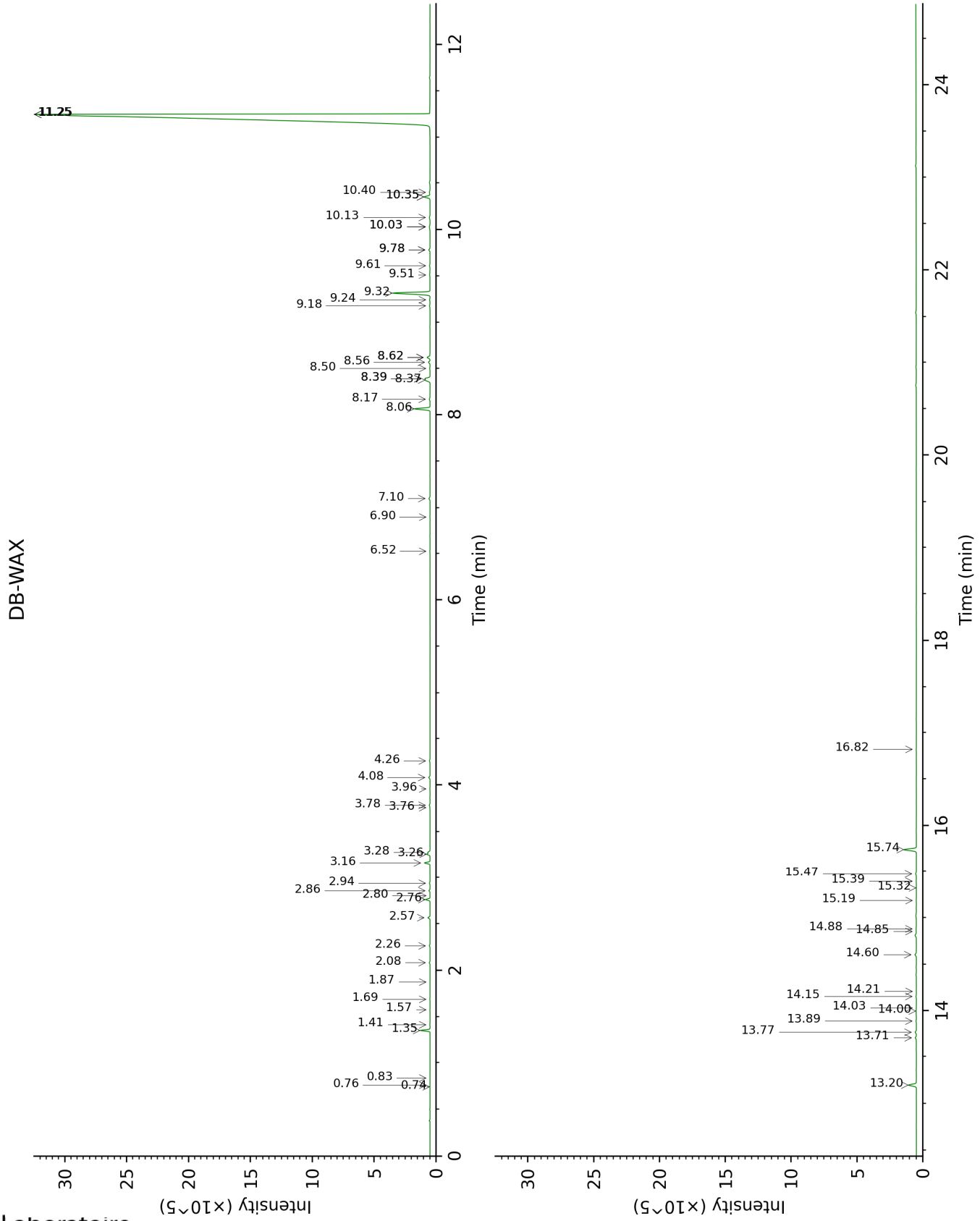

DB-5
12.35
12.27
12.26
12.12
11.88
11.52
11.40
11.28
11.14
10.67
10.72
10.56
10.38
10.10
9.78
9.63
9.53
8.45
7.84
7.79
7.07
6.98
6.87
6.63
6.46
6.01
5.53
5.35
5.23
5.26
5.01
4.78
4.67
4.51
4.23
4.29
4.10
3.99
3.91
3.78
3.44
3.04
2.85
2.78
1.31
0.54
0.56
0.45
0.33
14.04
13.51
13.17
13.09
13.12
13.00
12.88
Time (min)
Intensity (×10^5)


DB-WAX
Intensity (×10^5)
Time (min)
11.25
10.40
10.35
10.13
10.03
9.78
9.61
9.51
9.32
9.24
9.18
8.62
8.56
8.50
8.39
8.37
8.17
8.06
7.10
6.90
6.52
4.26
4.08
3.96
3.78
3.76
3.28
3.26
3.16
2.94
2.86
2.80
2.76
2.57
2.26
2.08
1.87
1.69
1.57
1.41
1.35
0.83
0.76
0.74
16.82
15.74
15.47
15.39
15.32
15.19
14.88
14.85
14.60
14.21
14.15
14.03
14.00
13.89
13.77
13.71
13.20

FULL ANALYSIS DATA

Identification	Column DB-5			Column DB-WAX		
	R.T	R.I	%	R.T	R.I	%
Ethanol	0.33	498	0.01	0.84	905	tr
2-Methyl-3-buten-2-ol	0.45	606	0.01	1.58	1015	0.01
Isovaleral	0.54	641	tr	0.76	888	tr
2-Methylbutyral	0.56	652	tr	0.74	882	tr
Hexanal	1.31	801	tr	1.87	1045	0.01
α-Thujene	2.78	924	0.01	1.41	999	0.01
α-Pinene	2.85	929	0.56	1.35	991	0.56
Camphene	3.04	942	0.02	1.69	1026	0.01
β-Pinene	3.44*	969	0.10	2.08	1066	0.05
Sabinene	3.44*	969	[0.10]	2.26	1084	0.05
Myrcene	3.78	992	0.08	2.86	1134	0.07
α-Phellandrene	3.91*	1001	0.30	2.76	1126	0.30
Pseudolimonene	3.91*	1001	[0.30]	2.80	1130	0.01
Δ3-Carene	3.99	1006	0.14	2.57	1111	0.14
α-Terpinene	4.10	1013	0.04	2.94	1140	0.04
para-Cymene	4.23	1021	0.09	4.08	1229	0.09
Limonene	4.29*	1025	0.74	3.16	1158	0.37
β-Phellandrene	4.29*	1025	[0.74]	3.26	1166	0.22
1,8-Cineole	4.29*	1025	[0.74]	3.28	1167	0.15
(*Z*)-β-Ocimene	4.51	1039	0.01	3.76	1205	0.02
(*E*)-β-Ocimene	4.67	1049	0.01	3.96	1220	0.02
γ-Terpinene	4.78	1056	0.05	3.78	1207	0.06
cis-Linalool oxide (fur.)	5.01	1070	0.02	6.52	1404	0.01
Terpinolene	5.23†	1084	0.06	4.26	1242	0.05
trans-Linalool oxide (fur.)	5.26†	1086	[0.06]	6.90	1432	0.01
Methyl benzoate	5.35	1092	0.01	8.62*	1561	0.24
Linalool	5.53	1103	1.14	8.06	1519	1.15
trans-Pinocarveol	6.01	1134	tr	9.18	1605	0.05
Borneol	6.46	1162	0.01	9.78*	1653	0.10
Terpinen-4-ol	6.63	1173	0.12	8.56	1557	0.13
α-Terpineol	6.87	1189	0.09	9.78*	1653	[0.10]
Methylchavicol	6.98	1196	3.13	9.32	1616	3.15
Dihydroanethole	7.07	1202	0.06	8.62*	1561	[0.24]
(*Z*)-Anethole	7.79†	1250	0.83	10.35*	1700	0.49
para-Anisaldehyde	7.84†	1253	[0.83]	13.20	1948	0.65
(*E*)-Anethole	8.45	1294	88.67	11.25*	1775	87.87
α-Copaene	9.53	1369	0.08	7.10	1447	0.08
Unknown [121, 91 (60), 120 (39), 164 (37), 77 (34), 135 (26)]	9.63*	1377	0.20	13.71	1995	0.09
Methyl para-anisate	9.63*	1377	[0.20]	13.89	2012	0.03
para-Acetonylanisole	9.63*	1377	[0.20]	14.60	2081	0.13
β-Elemene	9.78	1387	0.03	8.37†	1542	0.75
β-Caryophyllene	10.10*	1410	0.41	8.39*†	1544	[0.75]
cis-α-Bergamotene	10.10*	1410	[0.41]	8.17	1527	0.06
trans-α-Bergamotene	10.38*	1431	0.42	8.39*†	1544	[0.75]
Aromadendrene	10.38*	1431	[0.42]	8.50	1552	0.03
α-Humulene	10.56	1444	0.04	9.24	1610	0.04

Methyl (*Z*)-isoeugenol	10.67	1452	0.06	14.15	2038	0.04
(*E*)-β-Farnesene	10.72	1456	0.04	9.51	1632	0.04
Bicyclogermacrene	11.14*	1487	0.11	10.03*	1673	0.09
Viridiflorene	11.14*	1487	[0.11]	9.61	1640	0.05
α-Muurolene	11.28	1498	0.05	10.03*	1673	[0.09]
β-Bisabolene	11.40*	1507	0.08	10.13	1682	0.08
γ-Cadinene	11.40*	1507	[0.08]	10.35*	1700	[0.49]
δ-Cadinene	11.52*	1517	0.08	10.40	1704	0.07
trans-Calamenene	11.52*	1517	[0.08]	11.25*	1775	[87.87]
α-Elemol	11.88	1545	0.01	14.03	2026	0.01
(*E*)-Nerolidol	12.12	1563	0.08	13.77	2001	0.10
1-(4-Methoxyphenyl)propane-1,2-diol isomer I	12.26	1574	0.04			
1-(4-Methoxyphenyl)propane-1,2-diol isomer II	12.27	1575	0.06			
Viridiflorol	12.35*	1582	0.08	14.00	2023	0.03
(*Z*)-Foeniculin	12.35*	1582	[0.08]	14.21	2043	0.01
γ-Eudesmol	12.88	1624	0.01	14.88	2108	0.03
τ-Cadinol	13.00	1634	0.04	14.85	2106	0.02
β-Eudesmol	13.09*	1641	0.02	15.39	2160	0.02
α-Muurolol	13.09*	1641	[0.02]	15.19	2139	0.01
α-Eudesmol	13.12	1644	0.01	15.32	2152	0.01
α-Cadinol	13.17	1648	0.06	15.47	2168	0.06
(*E*)-Foeniculin	13.51	1676	1.05	15.74	2194	1.02
(2*E*,6*E*)-Farnesol	14.04	1721	0.01	16.82	2307	0.01
Total identified		**99.41%**			**98.91%**	
Total reported		**99.41%**			**99.00%**	

*: 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