CERTIFICATE OF ANALYSIS – GC PROFILING

SAMPLE IDENTIFICATION

Internal code : 18K09-PTH1-1-CC
Customer identification : Bergamot BF - Italy - B3010683R
Type : Essential oil
Source : *Citrus aurantium* var. *bergamia*
Customer : Plant Therapy

ANALYSIS

Method: PC-PA-014-17J19 - 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 : November 14, 2018

Checked and approved by :

_____

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

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PHYSICOCHEMICAL DATA

Physical aspect: Faintly yellow liquid
Refractive index: 1.4640 ± 0.0003 (20 ℃)

CONCLUSION

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

ANALYSIS SUMMARY

Identification	DB-5 (%)	DB-WAX (%)	Classe
Hashishene	tr	0.31*	Monoterpene
Tricyclene	tr	tr	Monoterpene
α-Thujene	0.32	[0.31]*	Monoterpene
α-Pinene	1.32	1.31	Monoterpene
Camphene	0.03	0.03	Monoterpene
Sabinene	9.87*	1.26	Monoterpene
β-Pinene	[9.87]*	8.51	Monoterpene
Myrcene	0.87	0.86	Monoterpene
α-Phellandrene	0.03	0.02	Monoterpene
Octanal	0.01	0.01	Aliphatic aldehyde
Δ3-Carene	0.01	0.01	Monoterpene
α-Terpinene	0.07	0.07	Monoterpene
para-Cymene	35.41	0.38	Monoterpene
1,8-Cineole	[35.41]*	0.13*	Monoterpenic ether
β-Phellandrene	[35.41]*	[0.13]*	Monoterpene
Limonene	[35.41]*	34.58	Monoterpene
(Z)-β-Ocimene	0.03	7.04*	Monoterpene
(E)-β-Ocimene	0.06	0.06	Monoterpene
γ-Terpinene	7.07	[7.04]*	Monoterpene
cis-Sabinene hydrate	tr	0.01	Monoterpenic alcohol
cis-Linalool oxide (fur.)	0.03	0.03	Monoterpenic alcohol
Octanol	tr	12.54*	Aliphatic alcohol
Terpinolene	0.39*	0.32	Monoterpene
trans-Linalool oxide (fur.)	[0.39]*	0.07	Monoterpenic alcohol
Linalool	12.15*	[12.54]*	Monoterpenic alcohol
Nonanal	[12.15]*	0.02	Aliphatic aldehyde
cis-Limonene oxide	0.01	0.01	Monoterpenic ether
Camphor	0.01	0.01	Monoterpenic ketone
trans-Limonene oxide	0.01	0.01	Monoterpenic ether
Citronellal	0.02	0.02	Monoterpenic aldehyde
Borneol	tr	0.18*	Monoterpenic alcohol
Terpinen-4-ol	0.05	0.05	Monoterpenic alcohol
α-Terpineol	0.18	[0.18]*	Monoterpenic alcohol
Decanal	tr	tr	Aliphatic aldehyde
Octyl acetate	0.11	0.11	Aliphatic ester
Nerol	tr	tr	Monoterpenic alcohol
Citronellol	0.01	0.01	Monoterpenic alcohol
Neral	0.14	0.13	Monoterpenic aldehyde
Geraniol	28.04*	tr	Monoterpenic alcohol
Linalyl acetate	[28.04]*	28.18*	Monoterpenic ester
Unknown	[28.04]*	0.01	Unknown
Geranial	0.31	0.22	Monoterpenic aldehyde
Unknown	tr		Unknown
Bornyl acetate	0.02	[28.18]*	Monoterpenic ester
cis-para-Mentha-2,8-diene-1-hydroperoxide	tr		Monoterpenic peroxide
trans-para-Mentha-2,8-diene-1-hydroperoxide	tr		Monoterpenic peroxide

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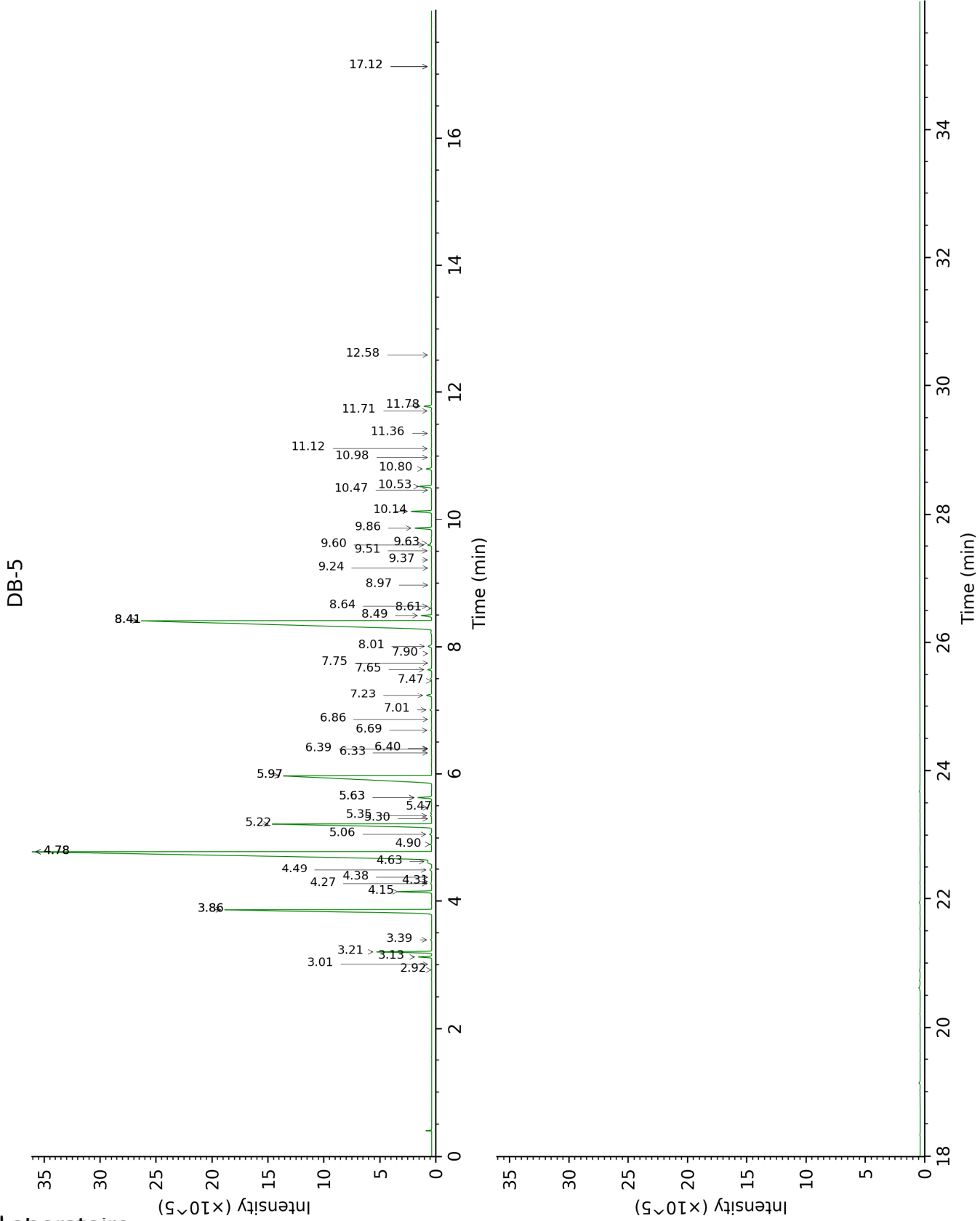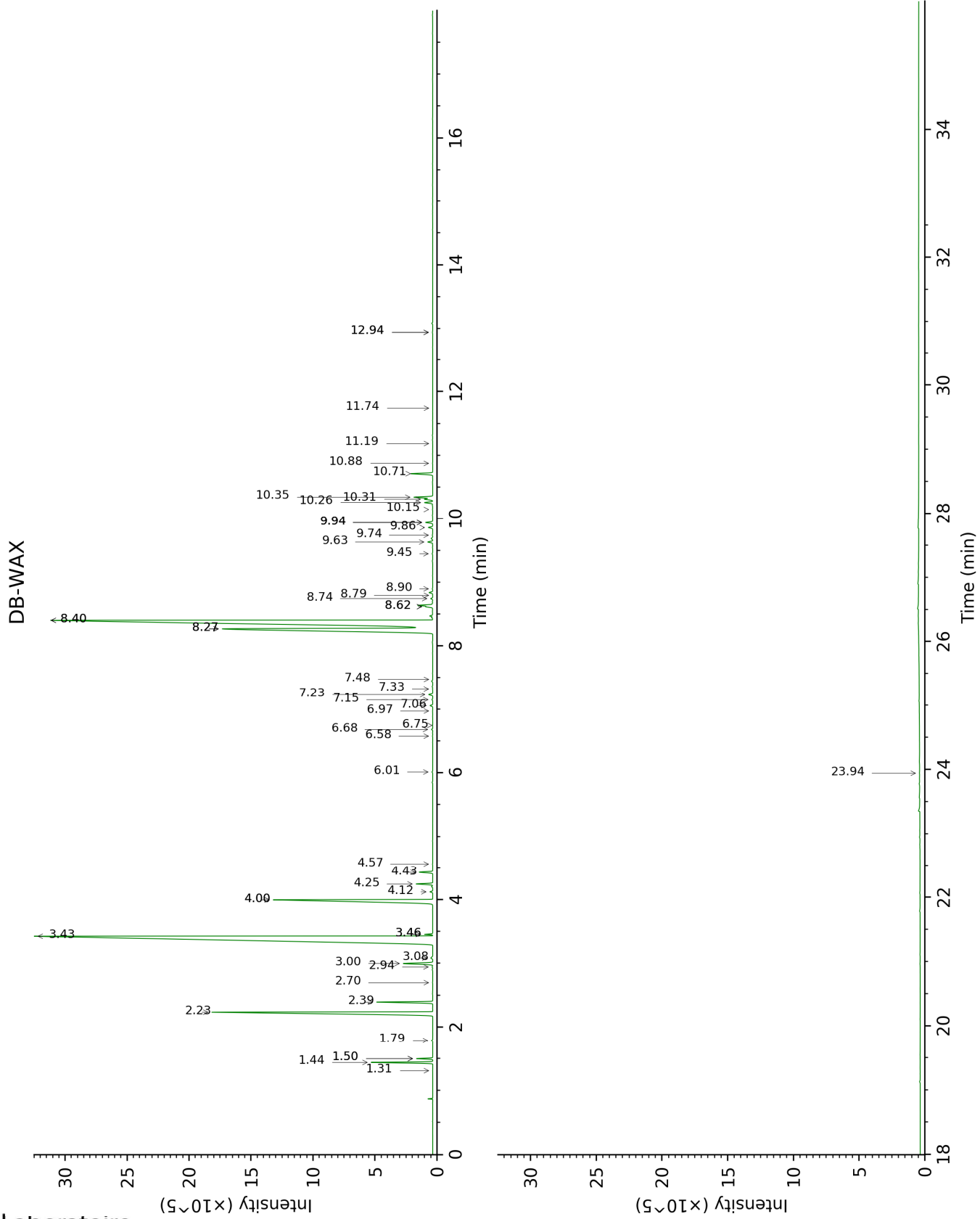|			
para-Mentha-1,8-diene-4-hydroperoxide	0.01		Monoterpenic peroxide
Linalyl propionate	0.02	0.01	Monoterpenic ester
α-Terpinyl acetate	0.12	0.12	Monoterpenic ester
Unknown	0.03		Monoterpenic ester
Neryl acetate	0.49	0.51	Monoterpenic ester
Geranyl acetate	0.58	0.59	Monoterpenic ester
Dodecanal	0.01	0.01	Aliphatic aldehyde
β-Caryophyllene	0.40	0.54*	Sesquiterpene
trans-α-Bergamotene	0.16	[0.54]*	Sesquiterpene
α-Humulene	0.02	0.02	Sesquiterpene
(E)-β-Farnesene	0.02	0.01	Sesquiterpene
Germacrene D	0.01	[0.18]*	Sesquiterpene
Hodiendiol derivative II	0.02	0.02*	Oxygenated monoterpene
β-Bisabolene	0.23	0.23	Sesquiterpene
Caryophyllene oxide	0.01	[0.02]*	Sesquiterpenic ether
Unknown	0.02*		Unknown
Citropten	[0.02]*	0.01	Furanocoumarin
Total identified	**98.70%**	**98.60%**	

*: Two or more compounds are coeluting on this column
[xx]: Duplicate percentage due to coelutions, not taken account in the identified total
tr: The compound has been detected below 0.005% of total signal.

Note: no correction factor was applied

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DB-5

Time (min)

Time (min)

Intensity (×10^5)

Intensity (×10^5)

DB-WAX

FULL ANALYSIS DATA

Identification	Column DB-5			Column DB-WAX		
	R.T	R.I	%	R.T	R.I	%
Hashishene	2.92	912	tr	1.50*	1002	0.31
Tricyclene	3.01	917	tr	1.31	975	tr
α-Thujene	3.13	925	0.32	1.50*	1002	[0.31]
α-Pinene	3.20	930	1.32	1.44	994	1.31
Camphene	3.39	942	0.03	1.79	1029	0.03
Sabinene	3.86*	973	9.87	2.39	1086	1.26
β-Pinene	3.86*	973	[9.87]	2.24	1071	8.51
Myrcene	4.15	992	0.87	3.00	1135	0.86
α-Phellandrene	4.27	1000	0.03	2.94	1131	0.02
Octanal	4.31	1002	0.01	4.57	1256	0.01
Δ3-Carene	4.38	1007	0.01	2.70	1112	0.01
α-Terpinene	4.49	1014	0.07	3.08	1142	0.07
para-Cymene	4.63†	1023	35.41	4.25	1232	0.38
1,8-Cineole	4.78*†	1032	[35.41]	3.46*	1171	0.13
β-Phellandrene	4.78*†	1032	[35.41]	3.46*	1171	[0.13]
Limonene	4.78*†	1032	[35.41]	3.43	1169	34.58
(Z)-β-Ocimene	4.90	1040	0.03	4.00*	1213	7.04
(E)-β-Ocimene	5.06	1050	0.06	4.12	1222	0.06
γ-Terpinene	5.22	1060	7.07	4.00*	1213	[7.04]
cis-Sabinene hydrate	5.30	1065	tr	6.97	1426	0.01
cis-Linalool oxide (fur.)	5.35	1068	0.03	6.68	1404	0.03
Octanol	5.47	1076	tr	8.27*	1523	12.54
Terpinolene	5.63*	1086	0.39	4.43	1246	0.32
trans-Linalool oxide (fur.)	5.63*	1086	[0.39]	7.06	1432	0.07
Linalool	5.97*	1108	12.15	8.27*	1523	[12.54]
Nonanal	5.97*	1108	[12.15]	6.01	1356	0.02
cis-Limonene oxide	6.33	1131	0.01	6.58	1396	0.01
Camphor	6.39	1135	0.01	7.32	1452	0.01
trans-Limonene oxide	6.40	1135	0.01	6.74	1409	0.01
Citronellal	6.69	1154	0.02	7.15	1439	0.02
Borneol	6.86	1165	tr	9.94*	1654	0.18
Terpinen-4-ol	7.01	1175	0.05	8.74	1559	0.05
α-Terpineol	7.23	1189	0.18	9.94*	1654	[0.18]
Decanal	7.47	1205	tr	7.48	1463	tr
Octyl acetate	7.65	1217	0.11	7.23	1445	0.11
Nerol	7.75	1224	tr	11.19	1758	tr
Citronellol	7.90	1234	0.01	10.88	1731	0.01
Neral	8.01	1242	0.14	9.63	1629	0.13
Geraniol	8.41*	1269	28.04	11.74	1805	tr
Linalyl acetate	8.41*	1269	[28.04]	8.40*	1533	28.18
Unknown [m/z 43, 111 (47), 93 (41), 55 (28), 67	8.41*	1269	[28.04]	8.80	1563	0.01

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(23), 41 (22)...]						
Geranial	8.49	1275	0.31	10.26	1680	0.22
Unknown [m/z 43, 121 (74), 93 (42), 95 (38), 107 (29), 41 (29), 136 (28)...]	8.61	1283	tr			
Bornyl acetate	8.64	1285	0.02	8.40*	1533	[28.18]
cis-para-Mentha-2,8-diene-1-hydroperoxide	8.97	1308	tr			
trans-para-Mentha-2,8-diene-1-hydroperoxide	9.24	1321	tr			
para-Mentha-1,8-diene-4-hydroperoxide	9.37	1330	0.01			
Linalyl propionate	9.51	1340	0.02	8.90	1571	0.01
α-Terpinyl acetate	9.60	1346	0.12	9.86	1648	0.12
Unknown [m/z 43, 121 (52), 93 (48), 79 (33), 41 (30), 136 (26), 81 (25)...]	9.63	1348	0.03			
Neryl acetate	9.86	1365	0.49	10.34	1687	0.51
Geranyl acetate	10.14	1385	0.58	10.71	1718	0.59
Dodecanal	10.47	1409	0.01	10.15	1671	0.01
β-Caryophyllene	10.53	1413	0.40	8.62*†	1550	0.54
trans-α-Bergamotene	10.80	1434	0.16	8.62*†	1550	[0.54]
α-Humulene	10.98	1447	0.02	9.45	1614	0.02
(*E*)-β-Farnesene	11.12	1458	0.02	9.74	1638	0.01
Germacrene D	11.36	1476	0.01	9.94*	1654	[0.18]
Hodiendiol derivative II	11.71	1502	0.02	12.94*	1912	0.02
β-Bisabolene	11.78	1508	0.23	10.31	1684	0.23
Caryophyllene oxide	12.58	1571	0.01	12.94*	1912	[0.02]
Unknown [m/z 266, 43 (89), 44 (67), 176 (49), 207 (44), 55 (38)...]	17.12*	1968	0.02			
Citropten	17.12*	1968	[0.02]	23.94	3164	0.01
Total identified	**98.70%**			**98.60%**		

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| Total reported | 98.74% | 98.61% |

*: Two or more compounds are coeluting on this column

[xx]: Duplicate percentage due to coelutions, not taken account in the identified 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