

Date : January 24, 2019

CERTIFICATE OF ANALYSIS – GC PROFILING

SAMPLE IDENTIFICATION

Internal code : 19A10-PTH04-1-CC

Customer identification : Amyris - Haiti - AH0103710R

Type : Essential oil

Source : *Amyris balsamifera*

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 : Sylvain Mercier, M. Sc., Chimiste

Analysis date : January 14, 2019

Checked and approved by :

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

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PHYSICOCHEMICAL DATA

Physical aspect: Light yellow viscous liquid

Refractive index: 1.5055 ± 0.0003 (20 °C)

ISO 3525:2008 - OIL OF AMYRIS

Compound	Min. %	Max. %	Observed %	Complies?
Drimenol	0.7	5.0	1.5	Yes
β-Eudesmol	2.5	11.0	3.9	Yes
7-epi-α-Eudesmol	7.0	15.0	13.2	Yes
α-Eudesmol	3.0	9.0	3.1	Yes
Valerianol	15.0	35.0	22.5	Yes
γ-Eudesmol	4.0	12.0	5.2	Yes
10-epi-γ-Eudesmol	6.0	12.0	8.4	Yes
α-Elemol	5.0	15.0	8.8	Yes
Refractive index	1.5040	1.5120	1.5055	Yes

CONCLUSION

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

ANALYSIS SUMMARY

Identification	DB-5 (%)	DB-WAX (%)	Classe
Acetic acid	0.01	0.02*	Aliphatic acid
Toluene	tr	tr	Simple phenolic
Furfural	0.02	[0.02]*	Aliphatic alcohol
Limonene	tr		Monoterpene
α -Terpineol	0.01	0.81	Monoterpenic alcohol
Unknown	0.07	0.07	Ionone or analog
Unknown	0.03		Sesquiterpene
α -Copaene	tr	tr	Sesquiterpene
Unknown	0.05	0.05	Sesquiterpene
β -Elemene	0.12*	0.12	Sesquiterpene
7-epi-Sesquithujene	[0.12]*	0.01	Sesquiterpene
α -Gurjunene	0.01	0.03	Sesquiterpene
Sesquithujene	0.04	0.04	Sesquiterpene
β -Caryophyllene	0.19*	0.16	Sesquiterpene
<i>cis</i> - α -Bergamotene	[0.19]*	0.05	Sesquiterpene
γ -Elemene	0.06	0.09	Sesquiterpene
<i>trans</i> - α -Bergamotene	0.07	0.06	Sesquiterpene
epi- β -Santalene	0.04	0.03	Sesquiterpene
Cadina-4,11-diene	0.07	0.53*	Sesquiterpene
Unknown	0.56*	0.45*	Sesquiterpenic ether
α -Humulene	[0.56]*	0.10	Sesquiterpene
Muurolo-4,11-diene	0.16	1.02*	Sesquiterpene
Amorpha-4,11-diene	1.34*	0.19	Sesquiterpene
allo-Aromadendrene	[1.34]*	0.18	Sesquiterpene
β -Santalene	[1.34]*	[0.53]*	Sesquiterpene
Unknown	0.10	0.09	Sesquiterpenic ether
Selina-4,11-diene	0.34*	[0.45]*	Sesquiterpene
γ -Muurolole	[0.34]*	0.35	Sesquiterpene
Amorpha-4,7(11)-diene?	1.44	[1.02]*	Sesquiterpene
Unknown	1.12*	1.15*	Sesquiterpene
β -Selinene	[1.12]*	0.02	Sesquiterpene
ar-Curcumene	[1.12]*	0.84	Sesquiterpene
Valencene	0.75	0.77	Sesquiterpene
Unknown	4.06*	0.22*	Oxygenated sesquiterpene
Unknown	[4.06]*	[0.22]*	Oxygenated sesquiterpene
4-epi- <i>cis</i> -Dihydroagarofuran	[4.06]*	[1.15]*	Sesquiterpenic ether
α -Zingiberene	[4.06]	2.45*	Sesquiterpene
Unknown	1.74*	0.37	Oxygenated sesquiterpene
β -Dihydroagarofuran	[1.74]*	0.62*	Sesquiterpenic ether
β -Bisabolene	[1.74]*	[2.45]*	Sesquiterpene
7-epi- α -Selinene	[1.74]	[0.62]*	Sesquiterpene
Liguloxide analog III	0.21		Sesquiterpenic ether
δ -Cadinene	0.04*	0.04	Sesquiterpene
<i>trans</i> -Calamenene	[0.04]*	tr	Sesquiterpene
Unknown	4.06*	0.05	Oxygenated sesquiterpene
β -Sesquiphellandrene	[4.06]*	[5.85]	Sesquiterpene
α -Agarofuran	0.40	0.66	Sesquiterpenic ether
Selina-3,7(11)-diene	2.54	5.85	Sesquiterpene

α-Elemol	8.78	8.77*	Sesquiterpenic alcohol
(E)-Nerolidol	0.51	0.68	Sesquiterpenic alcohol
Spathulenol	0.21	0.04	Sesquiterpenic alcohol
Caryophyllene oxide	0.06*	0.02	Sesquiterpenic ether
Caryophyllene oxide isomer	[0.06]*	0.01	Sesquiterpenic ether
Eudesm-5-en-11-ol	0.77*	0.05	Sesquiterpenic alcohol
Eudesm-5-en-11-ol analog	[0.77]*	0.66	Sesquiterpenic alcohol
Humulene epoxide II	1.11*	0.11	Sesquiterpenic ether
Unknown	[1.11]*	0.95	Oxygenated sesquiterpene
Unknown	0.02	1.05*	Oxygenated sesquiterpene
cis-Zingiberenol	0.12	0.16	Sesquiterpenic alcohol
10-epi-γ-Eudesmol	8.42	7.96	Sesquiterpenic alcohol
Unknown	1.15	[1.05]*	Oxygenated sesquiterpene
Unknown	0.39	0.50	Sesquiterpenic alcohol
γ-Eudesmol	5.57*	5.23	Sesquiterpenic alcohol
Unknown	[5.57]*	0.20	Oxygenated sesquiterpene
Eremoligenol	[5.57]*	0.27*	Sesquiterpenic alcohol
Hinesol	0.42*	[0.27]*	Sesquiterpenic alcohol
Agarospinol?	[0.42]*	0.26	Sesquiterpenic alcohol
Unknown	1.56*	[8.77]*	Oxygenated sesquiterpene
Unknown	[1.56]*	0.79	Oxygenated sesquiterpene
Selin-11-en-4α-ol	42.76*	0.16	Sesquiterpenic alcohol
β-Eudesmol	[42.76]*	3.91*	Sesquiterpenic alcohol
4α-Hydroxydihydroagarofuran	[42.76]*	[3.91]*	Sesquiterpenic alcohol
Valerianol	[42.76]*	22.47	Sesquiterpenic alcohol
α-Eudesmol	[42.76]*	3.09	Sesquiterpenic alcohol
trans-Calamenen-10-ol	[42.76]*	0.75*	Sesquiterpenic alcohol
7-epi-α-Eudesmol	[42.76]*	13.25	Sesquiterpenic alcohol
Dehydrojinkoh-eremol	0.56	0.50	Sesquiterpenic alcohol
Unknown	0.71	0.78	Oxygenated sesquiterpene
Unknown	0.29*	0.10	Oxygenated sesquiterpene
Unknown	[0.29]*	0.22	Oxygenated sesquiterpene
Caryophyllene acetate	[0.29]	0.03	Sesquiterpenic ester
Unknown	0.09	0.09	Oxygenated sesquiterpene
Unknown	0.67	[0.75]*	Oxygenated sesquiterpene
3β,4β-Oxidoagarofuran?	0.05	0.04	Sesquiterpenic ether
(2E,6E)-Farnesol	0.24	[0.75]*	Sesquiterpenic alcohol
(6R,7R)-Bisabolone	0.44	0.18	Sesquiterpenic ketone
(6S,7R)-Bisabolone	0.49*	0.36	Sesquiterpenic ketone
Unknown	[0.49]*	0.04	Oxygenated sesquiterpene
Drimenol	1.50	1.48	Sesquiterpenic alcohol
Cryptomeridiol analog	0.05	0.03	Sesquiterpenic alcohol
Cryptomeridiol	0.10	0.07	Sesquiterpenic alcohol
Unknown	0.04	0.02	Oxygenated sesquiterpene
Unknown	0.01		Oxygenated sesquiterpene
Unknown	0.01	0.01	Oxygenated sesquiterpene
Unknown	0.02		Oxygenated sesquiterpene
Unknown	0.04	0.05*	Oxygenated sesquiterpene
Unknown	0.01		Oxygenated sesquiterpene
Carissone analog I	0.01	0.01	Sesquiterpenic alcohol
Carissone analog II	0.01	[0.05]*	Sesquiterpenic alcohol
Total identified	93.41%	88.49%	

*: Two or more compounds are coeluting on this column

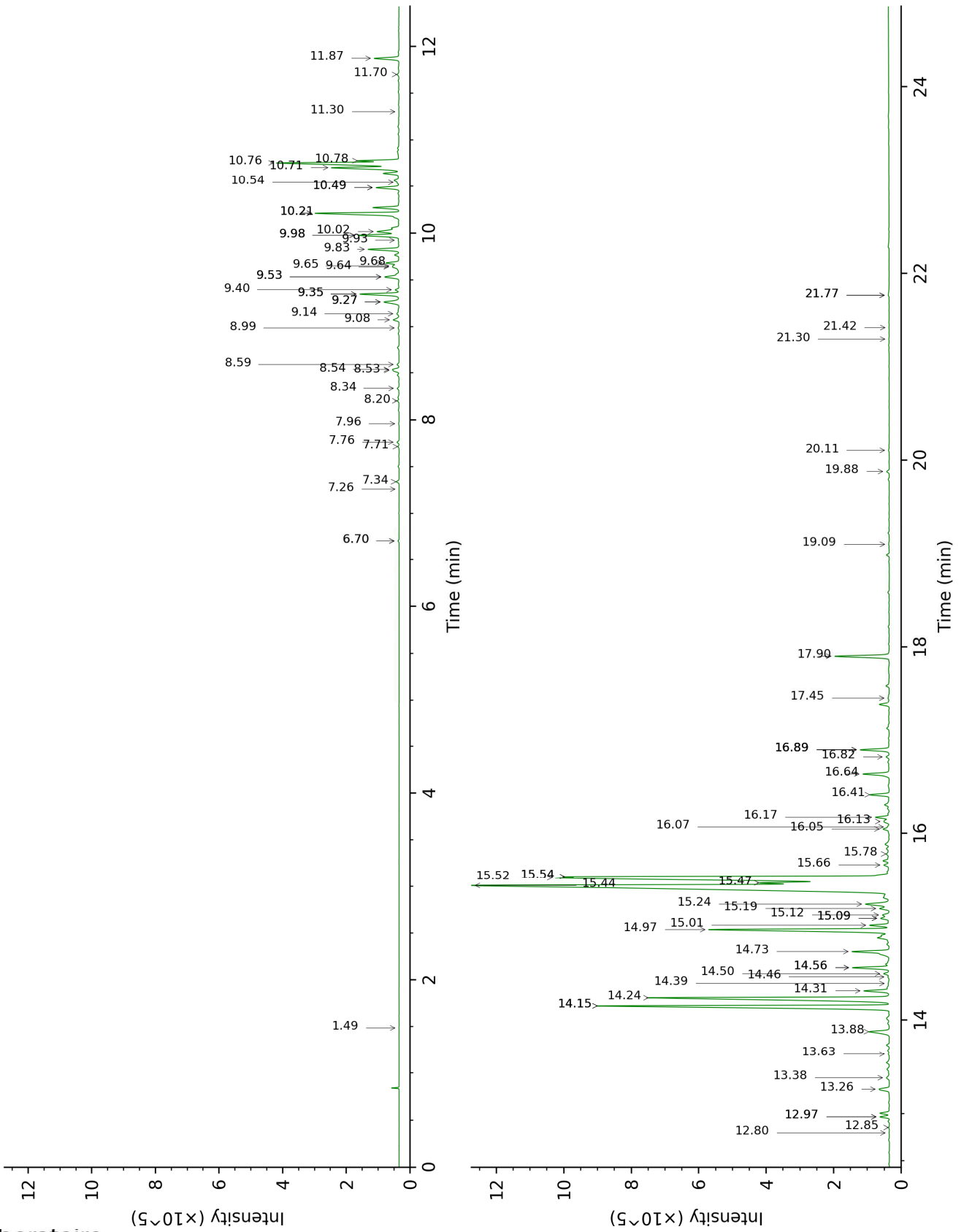
[xx]: Duplicate percentage due to coelutions, not taken account in the identified total

tr: The compound has been detected below 0.005% of total signal.

Note: no correction factor was applied

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DB-WAX



FULL ANALYSIS DATA

Identification	Column DB-5			Column DB-WAX		
	R.T	R.I	%	R.T	R.I	%
Acetic acid	0.54	605	0.01	6.70*	1409	0.02
Toluene	1.23	756	tr	1.49	1004	tr
Furfural	1.87	828	0.02	6.70*	1409	[0.02]
Limonene	4.66	1025	tr			
α -Terpineol	7.20	1187	0.01	9.83	1652	0.81
Unknown [m/z 177, 107 (57), 81 (55), 95 (50), 41 (34), 93 (34), 123 (32)... 192 (23)]	9.58	1347	0.07	7.34	1457	0.07
Unknown [m/z 123, 81 (45), 107 (30), 79 (28), 41 (28)... 204 (5)]	9.67	1354	0.03			
α -Copaene	9.94	1373	tr	7.26	1451	tr
Unknown [m/z 189, 105 (79), 91 (73), 107 (67), 93 (65), 133 (65)... 204 (38)]	10.07	1382	0.05	7.76	1488	0.05
β -Elemene	10.18*	1390	0.12	8.53	1548	0.12
7-epi-Sesquithujene	10.18*	1390	[0.12]	7.96	1503	0.01
α -Gurjunene	10.32	1400	0.01	7.72	1485	0.03
Sesquithujene	10.40	1406	0.04	8.20	1522	0.04
β -Caryophyllene	10.51*	1414	0.19	8.54	1548	0.16
<i>cis</i> - α -Bergamotene	10.51*	1414	[0.19]	8.34	1533	0.05
γ -Elemene	10.69	1427	0.06	9.14	1596	0.09
<i>trans</i> - α -Bergamotene	10.79	1434	0.07	8.59	1553	0.06
epi- β -Santalene	10.89	1442	0.04	8.99	1584	0.03
Cadina-4,11-diene	10.93	1445	0.07	9.27*	1606	0.53
Unknown [m/z 109, 81 (84), 207 (73), 43 (55), 41 (52), 69 (48), 55 (47), 124 (39)]	10.97*	1448	0.56	9.53*	1628	0.45
α -Humulene	10.97*	1448	[0.56]	9.40	1616	0.10
Muurola-4,11-diene	11.03	1453	0.16	9.35*	1612	1.02
Amorpha-4,11-diene	11.09*	1457	1.34	9.64	1636	0.19
allo-Aromadendrene	11.09*	1457	[1.34]	9.08	1590	0.18
β -Santalene	11.09*	1457	[1.34]	9.27*	1606	[0.53]
Unknown [m/z 109, 207 (91), 81 (91), 43 (79), 41 (71), 69 (57), 55 (54), 124 (47)]	11.15	1461	0.10	9.65	1637	0.09
Selina-4,11-diene	11.29*	1472	0.34	9.53*	1628	[0.45]
γ -Muurolene	11.29*	1472	[0.34]	9.68	1640	0.35
Amorpha-4,7(11)-diene?	11.38	1479	1.44	9.35*	1612	[1.02]
Unknown [m/z 189, 91 (95), 105 (93), 133 (84), 119 (75), 41 (59), 93 (46)... 204 (33)]	11.42*	1482	1.12	9.98*	1664	1.15
β -Selinene	11.42*	1482	[1.12]	9.92	1659	0.02
ar-Curcumene	11.42*	1482	[1.12]	10.78	1731	0.84

Valencene	11.52	1489	0.75	10.02	1667	0.77
Unknown [m/z 71, 69 (84), 93 (82), 109 (82), 41 (72), 43 (69), 81 (66), 55 (56), 79 (49)... 189 (37), 204 (3), 207 (3)]	11.57*†	1493	4.06	12.97*	1923	0.22
Unknown [m/z 71, 93 (86), 109 (84), 69 (77), 41 (75), 43 (72), 81 (63), 55 (54), 79 (51)... 189 (36), 204 (3), 207 (2)]	11.57*†	1493	[4.06]	12.97*	1923	[0.22]
4-epi-cis-Dihydroagarofuran	11.57*†	1493	[4.06]	9.98*	1664	[1.15]
α-Zingiberene	11.61†	1496	[4.06]	10.21*†	1683	2.45
Unknown [m/z 136, 121, (59), 93 (55), 80 (51), 81 (50), 71 (44), 123 (40)... 204 (3), 207 (1)]	11.78*†	1509	1.74	13.26	1950	0.37
β-Dihydroagarofuran	11.78*†	1509	[1.74]	10.49*	1706	0.62
β-Bisabolene	11.78*†	1509	[1.74]	10.21*†	1683	[2.45]
7-epi-α-Selinene	11.82†	1512	[1.74]	10.49*	1706	[0.62]
Liguloxide analog III	11.86	1515	0.21			
δ-Cadinene	11.93*	1521	0.04	10.54	1710	0.04
trans-Calamenene	11.93*	1521	[0.04]	11.30	1775	tr
Unknown [m/z 124, 109 (77), 123 (62), 105 (56), 91 (56), 41 (55), 43 (51), 205 (50)... 220 (21)]	11.98*	1525	4.06	11.70	1810	0.05
β-Sesquiphellandrene	11.98*	1525	[4.06]	10.76†	1729	[5.85]
α-Agarofuran	12.12	1535	0.40	11.87	1825	0.66
Selina-3,7(11)-diene	12.15	1538	2.54	10.71†	1724	5.85
α-Elemol	12.30	1550	8.78	14.15*	2035	8.77
(E)-Nerolidol	12.49	1565	0.51	13.88	2008	0.68
Spathulenol	12.58	1572	0.21	14.46	2065	0.04
Caryophyllene oxide	12.62*	1575	0.06	12.85	1913	0.02
Caryophyllene oxide isomer	12.62*	1575	[0.06]	12.80	1907	0.01
Eudesm-5-en-11-ol	12.90*	1597	0.77	14.39	2058	0.05
Eudesm-5-en-11-ol analog	12.90*	1597	[0.77]	14.31	2051	0.66
Humulene epoxide II	12.97*	1602	1.11	13.38	1962	0.11
Unknown [m/z 59, 91 (59), 105 (53), 93 (48), 161 (46), 79 (39), 123 (37)... 204 (12), 222 (1)]	12.97*	1602	[1.11]	14.73	2091	0.95
Unknown [m/z 43, 81 (97), 135 (71), 95 (62), 204 (61), 71 (59), 207 (56)... 222 (3)]	13.00	1605	0.02	14.56*†	2074	1.05
cis-Zingiberenol	13.06	1610	0.12	14.50	2068	0.16
10-epi-γ-Eudesmol	13.13	1616	8.42	14.24	2043	7.96
Unknown [m/z 161, 59 (59), 81 (50), 204 (49), 93 (36), 189 (34)... 220 (t)]	13.20	1621	1.15	14.56*†	2074	[1.05]

Unknown [m/z 161, 59 (61), 91 (45), 105 (43), 119 (41), 107 (36)... 204 (26), 222 (1)]	13.24	1625	0.39	15.01	2119	0.50
γ-Eudesmol	13.30*	1630	5.57	14.97	2114	5.23
Unknown [m/z 105, 161 (51), 91 (36), 59 (30), 147 (29), 189 (24), 204 (23)... 218 (t)]	13.30*	1630	[5.57]	15.12	2130	0.20
Eremoligenol	13.30*	1630	[5.57]	15.09*	2126	0.27
Hinesol	13.36*	1635	0.42	15.09*	2126	[0.27]
Agarospinol?	13.36*	1635	[0.42]	15.19	2137	0.26
Unknown [m/z 43, 41 (64), 109 (49), 69 (46), 95 (45), 55 (45)... 221 (23), 236 (31)]	13.43*	1641	1.56	14.15*	2035	[8.77]
Unknown [m/z 105, 59 (72), 161 (65), 147 (64), 91 (54), 43 (34), 189 (34)... 204 (30), 220 (1)]	13.43*	1641	[1.56]	15.24	2142	0.79
Selin-11-en-4α-ol	13.50*†	1647	42.76	15.66	2184	0.16
β-Eudesmol	13.50*†	1647	[42.76]	15.54*	2172	3.91
4α-Hydroxydihydroagarofuran	13.63*†	1657	[42.76]	15.54*	2172	[3.91]
Valerianol	13.63*†	1657	[42.76]	15.44	2162	22.47
α-Eudesmol	13.63*†	1657	[42.76]	15.47	2164	3.09
trans-Calamenen-10-ol	13.66*†	1660	[42.76]	16.90*	2312	0.75
7-epi-α-Eudesmol	13.66*†	1660	[42.76]	15.52	2170	13.25
Dehydrojinkoh-eremol	13.81	1672	0.56	16.41	2262	0.50
Unknown [m/z 109, 81 (67), 69 (64), 41 (63), 95 (46), 67 (35)... 207 (15)...]	13.93	1682	0.71	16.64	2285	0.78
Unknown [m/z 69, 41 (90), 123 (74), 122 (51)... 206 (14), 218 (2)]	13.98*†	1686	0.29	15.78	2196	0.10
Unknown [m/z 137, 119 (70), 84 (69), 41 (68), 69 (53), 55 (45), 109 (38)... 222 (2)]	13.98*†	1686	[0.29]	16.13	2232	0.22
Caryophyllene acetate	14.00†	1688	[0.29]	13.63	1986	0.03
Unknown [m/z 69, 41 (59), 118 (33), 43 (32), 55 (31)... 234? (t)]	14.06	1693	0.09	16.82	2304	0.09
Unknown [m/z 81, 136 (77), 109 (68), 121 (61), 41 (48), 93 (41), 79 (35), 107 (34), 123 (30)... 222 (1)]	14.14	1699	0.67	16.90*	2312	[0.75]
3β,4β-Oxidoagarofuran?	14.18	1703	0.05	16.07	2226	0.04
(2E,6E)-Farnesol	14.41	1723	0.24	16.90*	2312	[0.75]
(6R,7R)-Bisabolone	14.56	1736	0.44	16.05	2224	0.18
(6S,7R)-Bisabolone	14.65*	1743	0.49	16.17	2237	0.36
Unknown [m/z 137, 81 (78), 41 (74), 95 (74), 69	14.65*	1743	[0.49]	17.45	2373	0.04

(55), 91 (51)... 222 (8)]						
Drimenol	14.77	1754	1.50	17.90	2422	1.48
Cryptomeridiol analog	14.85	1761	0.05	19.10	2558	0.03
Cryptomeridiol	15.33	1803	0.10	19.88	2651	0.07
Unknown [m/z 69, 43 (95), 41 (84), 109 (78), 95 (54), 93 (49)... 177 (36), 220 (2)...]	15.35	1804	0.04	20.11	2678	0.02
Unknown [m/z 177, 43 (51), 138 (40), 59 (40), 205 (32)... 238 (5)]	15.63	1830	0.01			
Unknown [m/z 59, 43 (75), 121 (73), 105 (68), 107 (57), 177 (55), 123 (46)... 220 (39), 236 (1)]	15.94	1858	0.01	21.30	2826	0.01
Unknown [m/z 43, 109 (77), 69 (65), 41 (60), 55 (51), 95 (44), 135 (43)... 207 (19)...]	15.99	1862	0.02			
Unknown [m/z 59, 45 (92), 43 (70), 177 (58), 121 (58), 220 (57)... 236 (3)]	16.07	1870	0.04	21.77*	2886	0.05
Unknown [m/z 43, 109 (75), 59 (55), 41 (51), 69 (48), 152 (42)... 236 (5)]	16.14	1876	0.01			
Carissone analog I	16.53	1912	0.01	21.42	2842	0.01
Carissone analog II	16.56	1915	0.01	21.77*	2886	[0.05]
Total identified		93.41%			88.49%	
Total reported		96.84%			92.83%	

*: 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