Date : August 06, 2019

Certificate of Analysis – GC Profiling

Sample identification

Internal code : 19H05-PTH10-1-DM
Customer identification : Amyris- Haiti- AH0104711R
Type : Essential oil
Source : *Amyris balsamifera*
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 : Sylvain Mercier, M. Sc., Chimiste
Analysis date : August 06, 2019

Checked and approved by :

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

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PHYSICOCHEMICAL DATA

Physical aspect: Yellow viscous liquid
Refractive index: 1.5064 ± 0.0003 (20 °C)

ISO 3525:2008 - OIL OF AMYRIS

Compound	Min. %	Max. %	Observed %	Complies?
Drimenol	0.7	5.0	1.8	Yes
β-Eudesmol	2.5	11.0	3.3	Yes
7-epi-α-Eudesmol	7.0	15.0	14.3*	Yes
α-Eudesmol	3.0	9.0		
Valerianol	15.0	35.0	22.3	Yes
γ-Eudesmol	4.0	12.0	7.0	Yes
10-epi-γ-Eudesmol	6.0	12.0	7.6	Yes
α-Elemol	5.0	15.0	8.5	Yes
Refractive index	1.5040	1.5120	1.5064	Yes

*The compounds partially overlap on DB-Wax and coelute with other constituents on DB-5.

CONCLUSION

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

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Analysis summary – Consolidated contents

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

Identification	%	Classe
Acetic acid	0.01	Aliphatic acid
Toluene	tr	Simple phenolic
Furfural	0.01	Aliphatic alcohol
5-Methylfurfural	tr	Furan
α-Terpineol	tr	Monoterpenic alcohol
Unknown	0.08	Ionone or analog
Unknown	0.04	Sesquiterpene
α-Copaene	0.01	Sesquiterpene
Unknown	0.07	Sesquiterpene
β-Cubebene	0.01	Sesquiterpene
β-Elemene	0.10	Sesquiterpene
Sesquithujene	0.05	Sesquiterpene
cis-α-Bergamotene	0.04	Sesquiterpene
β-Caryophyllene	0.17	Sesquiterpene
γ-Elemene	0.03	Sesquiterpene
trans-α-Bergamotene	0.06	Sesquiterpene
epi-β-Santalene	0.03	Sesquiterpene
Cadina-4,11-diene	0.06	Sesquiterpene
α-Humulene	0.05	Sesquiterpene
Unknown	0.55	Sesquiterpenic ether
Muurola-4,11-diene	0.18	Sesquiterpene
β-Santalene	1.07	Sesquiterpene
Amorpha-4,11-diene	0.36	Sesquiterpene
allo-Aromadendrene	0.06	Sesquiterpene
γ-Muurolene	0.13	Sesquiterpene
Selina-4,11-diene	0.05	Sesquiterpene
Unknown	0.95	Sesquiterpene
β-Selinene	0.24	Sesquiterpene
ar-Curcumene	1.28	Sesquiterpene
Valencene	0.61	Sesquiterpene
Unknown	0.38	Oxygenated sesquiterpene
Unknown	0.40	Oxygenated sesquiterpene
4-epi-*cis*-Dihydroagarofuran	0.06	Sesquiterpenic ether
α-Zingiberene	2.40	Sesquiterpene
Unknown	0.65	Oxygenated sesquiterpene
β-Bisabolene	0.63	Sesquiterpene
β-Dihydroagarofuran	0.14	Sesquiterpenic ether
7-epi-α-Selinene	0.50	Sesquiterpene
Liguloxide analog III	0.32	Sesquiterpenic ether
δ-Cadinene	0.18	Sesquiterpene
trans-Calamenene	0.03	Sesquiterpene
β-Sesquiphellandrene	2.56	Sesquiterpene
Unknown	0.03	Oxygenated sesquiterpene
α-Agarofuran	0.49	Sesquiterpenic ether
Selina-3,7(11)-diene	1.86	Sesquiterpene
α-Elemol	8.46	Sesquiterpenic alcohol
(*E*)-Nerolidol	0.66	Sesquiterpenic alcohol

Spathulenol	0.23	Sesquiterpenic alcohol
Caryophyllene oxide	0.05	Sesquiterpenic ether
Caryophyllene oxide isomer	0.02	Sesquiterpenic ether
Eudesm-5-en-11-ol analog	0.74	Sesquiterpenic alcohol
Eudesm-5-en-11-ol	0.10	Sesquiterpenic alcohol
Humulene epoxide II	0.09	Sesquiterpenic ether
Unknown	0.91	Oxygenated sesquiterpene
Unknown	0.15	Oxygenated sesquiterpene
10-epi-γ-Eudesmol	7.61	Sesquiterpenic alcohol
Unknown	0.34	Sesquiterpenic alcohol
Unknown	1.24	Oxygenated sesquiterpene
γ-Eudesmol	6.99	Sesquiterpenic alcohol
Eremoligenol	0.23	Sesquiterpenic alcohol
Agarospirol?	0.28	Sesquiterpenic alcohol
Hinesol	0.35	Sesquiterpenic alcohol
Unknown	0.24	Oxygenated sesquiterpene
Unknown	1.09	Oxygenated sesquiterpene
Valerianol	22.31	Sesquiterpenic alcohol
Selin-11-en-4α-ol	0.19	Sesquiterpenic alcohol
β-Eudesmol	3.26	Sesquiterpenic alcohol
α-Eudesmol	14.25*	Sesquiterpenic alcohol
4α-Hydroxydihydroagarofuran	0.43	Sesquiterpenic alcohol
trans-Calamenen-10-ol	0.11	Sesquiterpenic alcohol
7-epi-α-Eudesmol	[14.25]*	Sesquiterpenic alcohol
Dehydrojinkoh-eremol	0.90	Sesquiterpenic alcohol
Unknown	0.71	Oxygenated sesquiterpene
Unknown	0.26	Oxygenated sesquiterpene
Unknown	0.04	Oxygenated sesquiterpene
Caryophyllene acetate	0.04	Sesquiterpenic ester
Unknown	0.65	Oxygenated sesquiterpene
3β,4β-Oxidoagarofuran?	0.16	Sesquiterpenic ether
(2*Z*,6*E*)-Farnesol	0.06	Sesquiterpenic alcohol
(2*E*,6*E*)-Farnesol	0.26	Sesquiterpenic alcohol
(6R,7R)-Bisabolone	0.59	Sesquiterpenic ketone
(6S,7R)-Bisabolone	0.63	Sesquiterpenic ketone
Drimenol	1.80	Sesquiterpenic alcohol
Cryptomeridiol analog	0.08	Sesquiterpenic alcohol
Cryptomeridiol	0.05	Sesquiterpenic alcohol
Unknown	0.06	Oxygenated sesquiterpene
Unknown	0.04	Oxygenated sesquiterpene
Unknown	0.01	Oxygenated sesquiterpene
Unknown	0.03	Oxygenated sesquiterpene
Unknown	0.05	Oxygenated sesquiterpene
Unknown	0.01	Oxygenated sesquiterpene
Unknown	0.01	Oxygenated sesquiterpene
Carissone analog I	0.01	Sesquiterpenic alcohol
Carissone analog II	0.01	Sesquiterpenic alcohol
Unknown	0.02	Oxygenated sesquiterpene
Consolidated total	**93.72%**	

*: 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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This page was intentionally left blank. The following pages present the complete data of the analysis.

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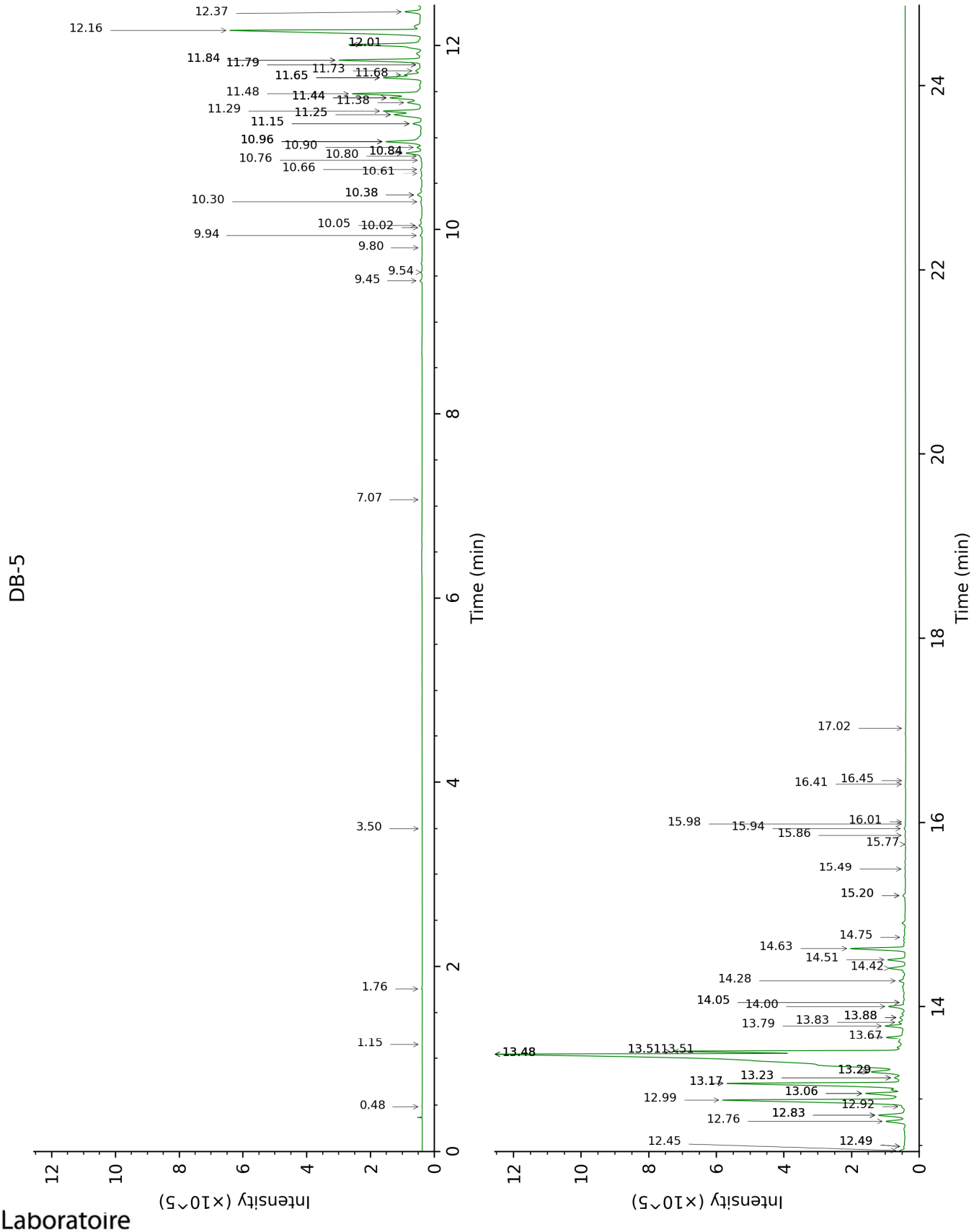
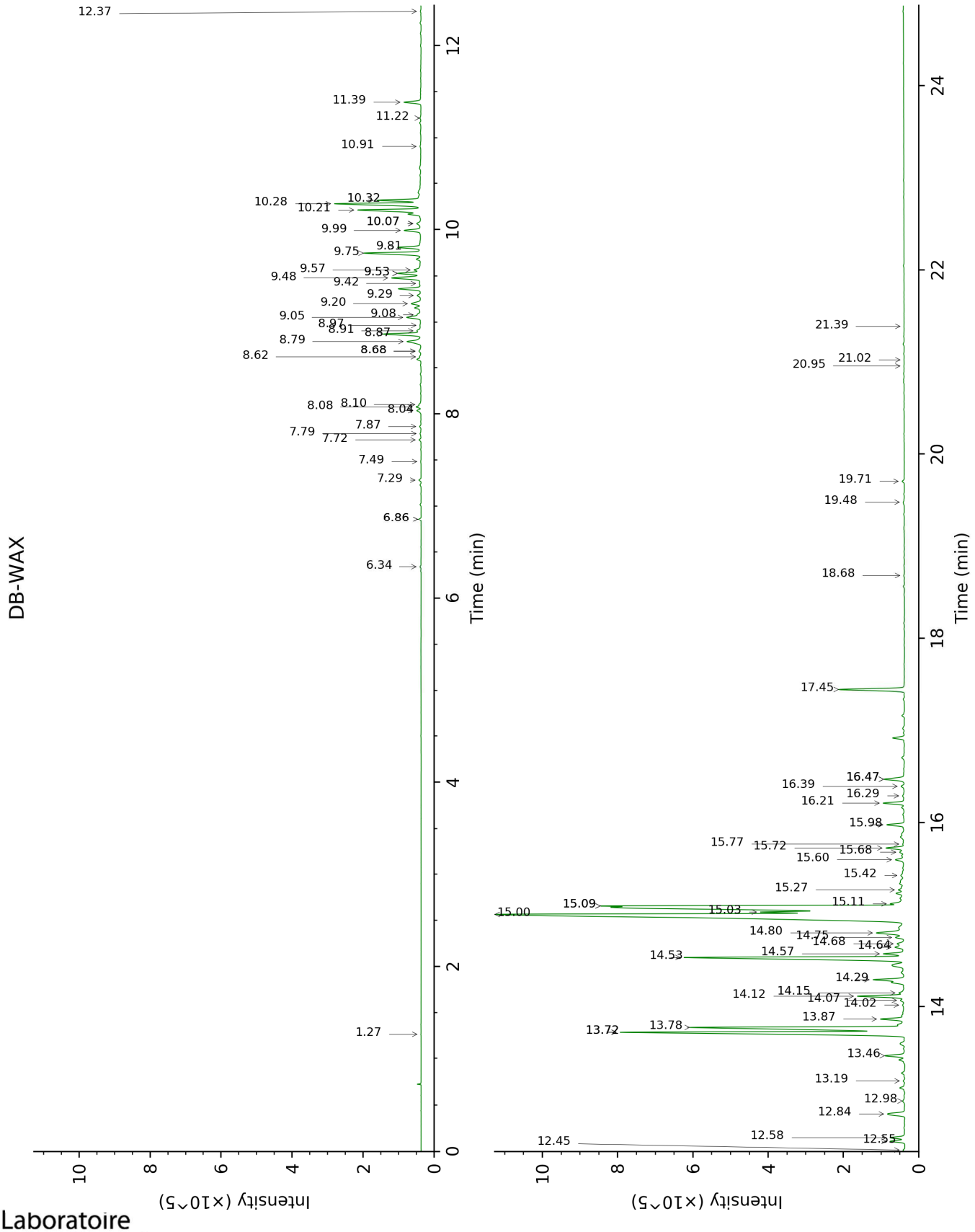

DB-5
12.37
12.16
12.01
11.84
11.79
11.73
11.65
11.68
11.48
11.44
11.38
11.29
11.25
11.15
10.96
10.90
10.80
10.84
10.76
10.66
10.61
10.38
10.30
10.05
10.02
9.94
9.80
9.54
9.45
7.07
3.50
1.76
1.15
0.48
Time (min)
Intensity (×10^5)
17.02
16.41
16.45
15.98
15.94
16.01
15.86
15.77
15.49
15.20
14.75
14.63
14.51
14.42
14.28
14.05
14.00
13.79
13.83
13.88
13.67
13.48
13.51
13.51
13.29
13.17
13.23
13.06
12.99
12.92
12.76
12.83
12.45
12.49
Time (min)
Intensity (×10^5)


DB-WAX
Time (min)
Intensity (×10^5)
12.37
11.39
11.22
10.91
10.28
10.21
10.32
10.07
9.99
9.75
9.81
9.48
9.57
9.53
9.42
9.29
9.20
9.05
9.08
8.97
8.91
8.87
8.79
8.68
8.62
8.08
8.10
8.04
7.87
7.79
7.72
7.49
7.29
6.86
6.34
1.27
21.39
21.02
20.95
19.71
19.48
18.68
17.45
16.47
16.39
16.29
16.21
15.98
15.77
15.72
15.68
15.60
15.42
15.27
15.11
15.09
15.03
15.00
14.80
14.75
14.68
14.64
14.57
14.53
14.29
14.15
14.12
14.07
14.02
13.87
13.78
13.72
13.46
13.19
12.98
12.84
12.58
12.55
12.45

FULL ANALYSIS DATA

Identification	Column DB-5			Column DB-WAX		
	R.T	R.I	%	R.T	R.I	%
Acetic acid	0.48	577	0.01			
Toluene	1.15	760	tr	1.27	1003	tr
Furfural	1.76	828	0.01	6.34	1413	0.02
5-Methylfurfural	3.50	958	tr	7.72	1516	0.06
α-Terpineol	7.07	1188	tr	9.42	1651	0.07
Unknown [m/z 177, 107 (57), 81 (55), 95 (50), 41 (34), 93 (34), 123 (32)... 192 (23)]	9.45	1347	0.08	6.86*	1451	0.07
Unknown [m/z 123, 81 (45), 107 (30), 79 (28), 41 (28)... 204 (5)]	9.54	1354	0.04			
α-Copaene	9.80	1372	0.01	6.86*	1451	[0.07]
Unknown [m/z 189, 105 (79), 91 (73), 107 (67), 93 (65), 133 (65)... 204 (38)]	9.94	1382	0.07	7.28	1483	0.06
β-Cubebene	10.02	1388	0.01	7.49	1498	0.02
β-Elemene	10.05	1390	0.10	8.08†	1544	[0.34]
Sesquithujene	10.30	1408	0.05	7.79	1522	0.05
cis-α-Bergamotene	10.38*	1413	0.22	7.86	1528	0.04
β-Caryophyllene	10.38*	1413	[0.22]	8.04†	1541	0.34
γ-Elemene	10.61	1431	0.03	8.68*	1591	0.09
trans-α-Bergamotene	10.66	1434	0.06	8.10†	1546	[0.34]
epi-β-Santalene	10.76	1442	0.03	8.62	1586	0.04
Cadina-4,11-diene	10.80	1445	0.06	8.79	1600	0.57
α-Humulene	10.84*	1448	0.60	8.97	1614	0.05
Unknown [m/z 109, 81 (84), 207 (73), 43 (55), 41 (52), 69 (48), 55 (47), 124 (39)]	10.84*	1448	[0.60]	9.05†	1621	0.60
Muurola-4,11-diene	10.90	1452	0.18	8.91	1609	0.14
β-Santalene	10.96*	1457	1.53	8.87	1606	1.07
Amorpha-4,11-diene	10.96*	1457	[1.53]	9.20	1633	0.36
allo-Aromadendrene	10.96*	1457	[1.53]	8.68*	1591	[0.09]
γ-Muurolene	11.16*	1472	0.37	9.29	1640	0.13
Selina-4,11-diene	11.16*	1472	[0.37]	9.08†	1623	[0.60]
Unknown [m/z 189, 91 (95), 105 (93), 133 (84), 119 (75), 41 (59), 93 (46)... 204 (33)]	11.25*	1479	1.28	9.48	1656	0.95
β-Selinene	11.25*	1479	[1.28]	9.57	1663	0.24
ar-Curcumene	11.29	1482	1.28	10.32	1725	1.13
Valencene	11.38	1489	0.61	9.53*	1660	0.67
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)]	11.44*	1492	1.25	12.55	1921	0.38

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)]	11.44*	1492	[1.25]	12.58	1924	0.40
4-epi-*cis*-Dihydroagarofuran	11.44*	1492	[1.25]	9.53*	1660	[0.67]
α-Zingiberene	11.48	1496	2.40	9.75	1678	1.65
Unknown [m/z 136, 121, (59), 93 (55), 80 (51), 81 (50), 71 (44), 123 (40)... 204 (3), 207 (1)]	11.65*	1509	1.42	12.84	1948	0.65
β-Bisabolene	11.65*	1509	[1.42]	9.81	1683	0.63
β-Dihydroagarofuran	11.65*	1509	[1.42]	10.07*	1704	0.17
7-epi-α-Selinene	11.68	1511	0.50	9.99	1698	0.53
Liguloxide analog III	11.73	1515	0.32			
δ-Cadinene	11.79*†	1520	2.79	10.07*	1704	[0.17]
trans-Calamenene	11.79*†	1520	[2.79]	10.91	1775	0.03
β-Sesquiphellandrene	11.84*†	1524	[2.79]	10.28	1722	2.56
Unknown [m/z 124, 109 (77), 123 (62), 105 (56), 91 (56), 41 (55), 43 (51), 205 (50)... 220 (21)]	11.84*†	1524	[2.79]	11.22	1802	0.03
α-Agarofuran	12.01*	1537	2.57	11.39	1817	0.49
Selina-3,7(11)-diene	12.01*	1537	[2.57]	10.21	1716	1.86
α-Elemol	12.16	1549	8.46	13.72*	2031	8.70
(*E*)-Nerolidol	12.37	1565	0.66	13.46	2006	0.55
Spathulenol	12.44	1571	0.23	14.07	2064	0.12
Caryophyllene oxide	12.49*	1575	0.09	12.45	1912	0.05
Caryophyllene oxide isomer	12.49*	1575	[0.09]	12.37	1904	0.02
Eudesm-5-en-11-ol analog	12.76	1596	0.74	13.87	2045	0.68
Eudesm-5-en-11-ol	12.83*	1601	1.09	14.02	2059	0.10
Humulene epoxide II	12.83*	1601	[1.09]	12.98	1961	0.09
Unknown [m/z 59, 91 (59), 105 (53), 93 (48), 161 (46), 79 (39), 123 (37)... 204 (12), 222 (1)]	12.83*	1601	[1.09]	14.29	2086	0.91
Unknown [m/z 43, 81 (97), 135 (71), 95 (62), 204 (61), 71 (59), 207 (56)... 222 (3)]	12.92	1609	0.15	14.15	2072	0.19
10-epi-γ-Eudesmol	12.99	1614	7.61	13.78	2036	7.10
Unknown [m/z 161, 59 (61), 91 (45), 105 (43), 119 (41), 107 (36)... 204 (26), 222 (1)]	13.06*	1620	1.58	14.57†	2114	[7.51]
Unknown [m/z 161, 59 (59), 81 (50), 204 (49), 93 (36), 189 (34)... 220 (t)]	13.06*	1620	[1.58]	14.12	2069	1.24
γ-Eudesmol	13.17*	1629	7.22	14.53†	2110	7.51
Eremoligenol	13.17*	1629	[7.22]	14.68	2124	0.23
Agarospirol?	13.23*	1634	0.53	14.75	2131	0.28

Hinesol	13.23*	1634	[0.53]	14.64	2121	0.35
Unknown [m/z 43, 41 (64), 109 (49), 69 (46), 95 (45), 55 (45)... 221 (23), 236 (31)]	13.29*	1640	1.66	13.72*	2031	[8.70]
Unknown [m/z 105, 59 (72), 161 (65), 147 (64), 91 (54), 43 (34), 189 (34)... 204 (30), 220 (1)]	13.29*	1640	[1.66]	14.80	2136	1.09
Valerianol	13.48*†	1655	40.55	15.00	2156	22.31
Selin-11-en-4α-ol	13.48*†	1655	[40.55]	15.26	2183	0.19
β-Eudesmol	13.48*†	1655	[40.55]	15.02	2159	3.26
α-Eudesmol	13.48*†	1655	[40.55]	15.09*	2165	15.32
4α-Hydroxydihydroagarofuran	13.51*†	1658	[40.55]	15.11	2168	0.43
trans-Calamenen-10-ol	13.51*†	1658	[40.55]	16.39	2300	0.11
7-epi-α-Eudesmol	13.51*†	1658	[40.55]	15.09*	2165	[15.32]
Dehydrojinkoh-eremol	13.67	1671	0.90	15.98	2256	0.49
Unknown [m/z 109, 81 (67), 69 (64), 41 (63), 95 (46), 67 (35)... 207 (15)...]	13.79	1681	0.71	16.21	2281	0.57
Unknown [m/z 69, 41 (90), 123 (74), 122 (51)... 206 (14), 218 (2)]	13.83	1684	0.26	15.42	2198	0.17
Unknown [m/z 137, 119 (70), 84 (69), 41 (68), 69 (53), 55 (45), 109 (38)... 222 (2)]	13.88*	1689	0.28	15.77	2235	0.04
Caryophyllene acetate	13.88*	1689	[0.28]	13.19	1981	0.04
Unknown [m/z 81, 136 (77), 109 (68), 121 (61), 41 (48), 93 (41), 79 (35), 107 (34), 123 (30)... 222 (1)]	14.00	1698	0.65	16.47*	2308	0.67
3β,4β-Oxidoagarofuran?	14.05*	1702	0.13	15.68	2226	0.16
(2*Z*,6*E*)-Farnesol	14.05*	1702	[0.13]	16.29	2289	0.06
(2*E*,6*E*)-Farnesol	14.28	1722	0.26	16.47*	2308	[0.67]
(6R,7R)-Bisabolone	14.42	1734	0.59	15.60	2217	0.31
(6S,7R)-Bisabolone	14.51	1742	0.63	15.72	2230	0.52
Drimenol	14.63	1752	1.80	17.45	2415	1.75
Cryptomeridiol analog	14.75	1763	0.08	18.68	2555	0.02
Cryptomeridiol	15.20*	1802	0.12	19.48	2650	0.05
Unknown [m/z 69, 43 (95), 41 (84), 109 (78), 95 (54), 93 (49)... 177 (36), 220 (2)...]	15.20*	1802	[0.12]	19.71	2677	0.06
Unknown [m/z 177, 43 (51), 138 (40), 59 (40), 205 (32)... 238 (5)]	15.49	1828	0.04			
Unknown [m/z 59, 43 (75), 121 (73), 105 (68), 107 (57), 177 (55), 123 (46)... 220 (39), 236 (1)]	15.76	1853	0.01	20.95	2832	0.01
Unknown [m/z 43, 109 (77), 69 (65), 41 (60), 55	15.86	1862	0.03			

(51), 95 (44), 135 (43)... 207 (19)...]						
Unknown [m/z 59, 45 (92), 43 (70), 177 (58), 121 (58), 220 (57)... 236 (3)]	15.94	1869	0.05			
Unknown [m/z 43, 59 (60), 123 (45), 176 (40)... 208 (10)...]	15.98	1873	0.01			
Unknown [m/z 43, 109 (75), 59 (55), 41 (51), 69 (48), 152 (42)... 236 (5)]	16.01	1875	0.01			
Carissone analog I	16.42	1913	0.01	21.02	2840	0.01
Carissone analog II	16.45	1916	0.01	21.39	2887	0.01
Unknown [m/z 59, 121 (66), 218 (27), 136 (26), 178 (26), 43 (24), 91 (24), 123 (23)... 238 (t)]	17.02	1970	0.02			
Total identified		**92.90%**			**84.56%**	
Total reported		**95.01%**			**91.91%**	

*: 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