CERTIFICATE OF ANALYSIS – GC PROFILING

SAMPLE IDENTIFICATION

Internal code : 19L05-PTH02-1-CC
Customer identification : Sandalwood, Indian - Australia - SA210299R
Type : Essential oil
Source : *Santalum album*
Customer : Plant Therapy

ANALYSIS

Method: PC-MAT-007 - Analysis of the composition of an essential oil or other volatile liquide by FAST GC-FID (in French); identifications validated by GC-MS.
Analyst : Sarah-Eve Tremblay, M. Sc. A., Chimiste
Analysis date : December 06, 2019

Checked and approved by :

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

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PHYSICOCHEMICAL DATA

Physical aspect: Faintly yellow viscous liquid
Refractive index: 1.5066 ± 0.0003 (20 °C)

ISO 3518:2002 - OIL OF SANDALWOOD

Compound	Min. %	Max. %	Observed %	Complies?
(Z)-β-Santalol	16	24	20	Yes
(Z)-α-Santalol	41	55	46	Yes
Refractive index	1.5030	1.5090	1.5066	Yes

CONCLUSION

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

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ANALYSIS SUMMARY – CONSOLIDATED CONTENTS

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

Identification	%	Classe
4-Methylacetophenone	0.03	Simple phenolic
Dihydroalbene	tr	Terpene derivative
Unknown	0.01	Terpene derivative
Teresantalic acid	0.04	Monoterpenic acid
Unknown	tr	Terpenic aldehyde
Unknown	tr	Unknown
Tricycloekasantalal	0.05	Terpenic aldehyde
(1S,5S,6R)-2,6-Dimethylbicyclo[3.1.1]hept-2-ene-6-propanal?	0.01	Terpenic aldehyde
Unknown	0.04	Unknown
7-epi-Sesquithujene	tr	Sesquiterpene
γ-4-Dimethylbenzenebutyral	0.02	Simple phenolic
α-Cedrene	0.02	Sesquiterpene
Sesquithujene	tr	Sesquiterpene
β-Cedrene	0.01	Sesquiterpene
α-Santalene	0.82	Sesquiterpene
trans-α-Bergamotene	0.18	Sesquiterpene
Unknown	0.01	Sesquiterpene
epi-β-Santalene	0.88	Sesquiterpene
α-Acoradiene	0.01	Sesquiterpene
Geranylacetone	tr	Monoterpenic ketone
(*E*)-β-Farnesene	0.03	Sesquiterpene
β-Santalene	1.29	Sesquiterpene
Unknown	0.02	Unknown
β-Acoradiene	0.01	Sesquiterpene
10-epi-β-Acoradiene	0.01	Sesquiterpene
γ-Curcumene	0.09	Sesquiterpene
ar-Curcumene	0.23	Sesquiterpene
α-Selinene	tr	Sesquiterpene
Unknown	0.01	Sesquiterpene
α-Alaskene	0.01	Sesquiterpene
β-Bisabolene	0.09	Sesquiterpene
β-Curcumene	0.22	Sesquiterpene
Unknown	0.09	Oxygenated sesquiterpene
β-Sesquiphellandrene	0.02	Sesquiterpene
8,14-Cedranoxide	0.02	Sesquiterpenic ether
Unknown	0.11	Sesquiterpene
Unknown	0.05	Sesquiterpene
(*E*)-Nerolidol	0.07	Sesquiterpenic alcohol
Unknown	0.02	Oxygenated sesquiterpene
Unknown	0.02	Oxygenated sesquiterpene
Dendrolasin	0.05	Sesquiterpenic ether
Helifolen-12-al A	0.01	Sesquiterpenic aldehyde
α-Cedrol	0.01	Sesquiterpenic alcohol
Helifolen-12-al B	0.03	Sesquiterpenic aldehyde
Unknown	0.10	Oxygenated sesquiterpene
Rosifoliol	0.04	Sesquiterpenic alcohol

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α-Acorenol	0.02	Sesquiterpenic alcohol
β-Acorenol	0.15	Sesquiterpenic alcohol
10-epi-β-Acorenol?	0.03	Sesquiterpenic alcohol
Unknown	0.39	Oxygenated sesquiterpene
β-Eudesmol	0.15	Sesquiterpenic alcohol
α-Bisabolol oxide B, epimer 1	0.34	Sesquiterpenic alcohol
α-Bisabolol oxide B, epimer 2	0.05	Sesquiterpenic alcohol
Unknown	0.55	Oxygenated sesquiterpene
Unknown	0.40	Oxygenated sesquiterpene
Bulnesol	0.02	Sesquiterpenic alcohol
β-Bisabolol	1.42	Sesquiterpenic alcohol
epi-Cyclosantalal	1.41	Sesquiterpenic aldehyde
(*E*)-α-Santalal	0.57	Sesquiterpenic aldehyde
(*Z*)-α-Santalol	46.26	Sesquiterpenic alcohol
(*Z*)-α-*trans*-Bergamotol	5.98	Sesquiterpenic alcohol
(*E*)-α-Santalol	0.40	Sesquiterpenic alcohol
Unknown	0.49	Oxygenated sesquiterpene
(*Z*)-epi-β-Santalol	3.86	Sesquiterpenic alcohol
(*E*)-α-*trans*-Bergamotol	0.30	Sesquiterpenic alcohol
Unknown	0.07	Oxygenated sesquiterpene
(*Z*)-β-Santalol	20.10	Sesquiterpenic alcohol
Unknown	0.40	Oxygenated sesquiterpene
(*Z*)-Nuciferol	0.86	Sesquiterpenic alcohol
(*E*)-β-Santalol	1.59	Sesquiterpenic alcohol
Unknown	0.55	Oxygenated sesquiterpene
(2*E*,6*E*)-Farnesal	0.36	Sesquiterpenic aldehyde
(*Z*)-γ-Curcumen-12-ol	0.44	Sesquiterpenic alcohol
(*Z*)-β-Curcumen-12-ol	0.65	Sesquiterpenic alcohol
(*Z*)-Lanceol	2.89	Sesquiterpenic alcohol
(*Z*)-α-Santalyl acetate	0.02	Sesquiterpenic ester
Unknown	0.11	Oxygenated sesquiterpene
Unknown	0.06	Oxygenated sesquiterpene
Unknown	0.26	Oxygenated sesquiterpene
Unknown	0.01	Oxygenated sesquiterpene
Unknown	0.10	Oxygenated sesquiterpene
Unknown	0.02	Oxygenated sesquiterpene
Unknown	0.01	Oxygenated sesquiterpene
Unknown	0.01	Oxygenated sesquiterpene
Unknown	0.02	Oxygenated sesquiterpene
Unknown	0.11	Oxygenated sesquiterpene
Consolidated total	**96.23%**	

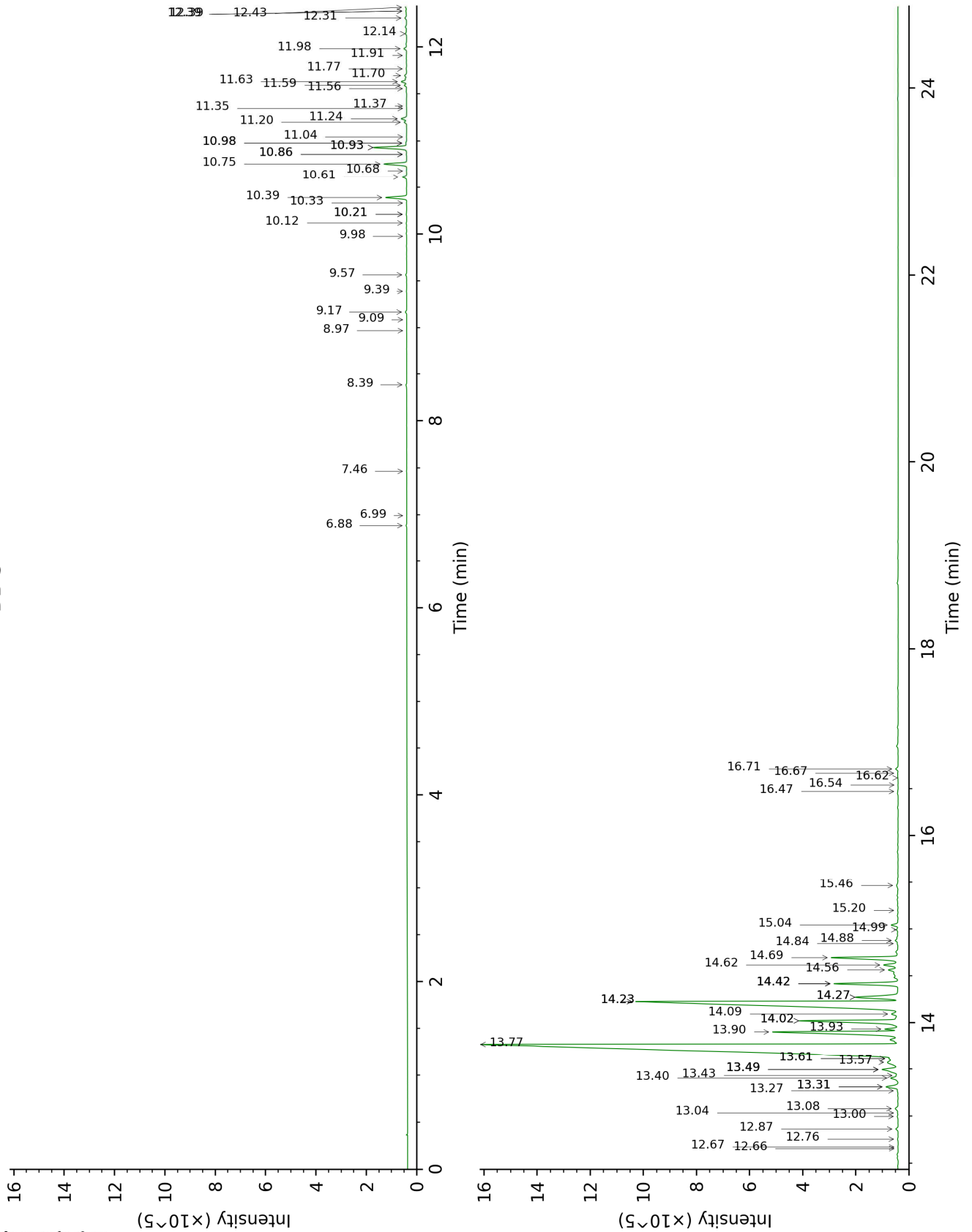tr: The compound has been detected below 0.005% of total signal.

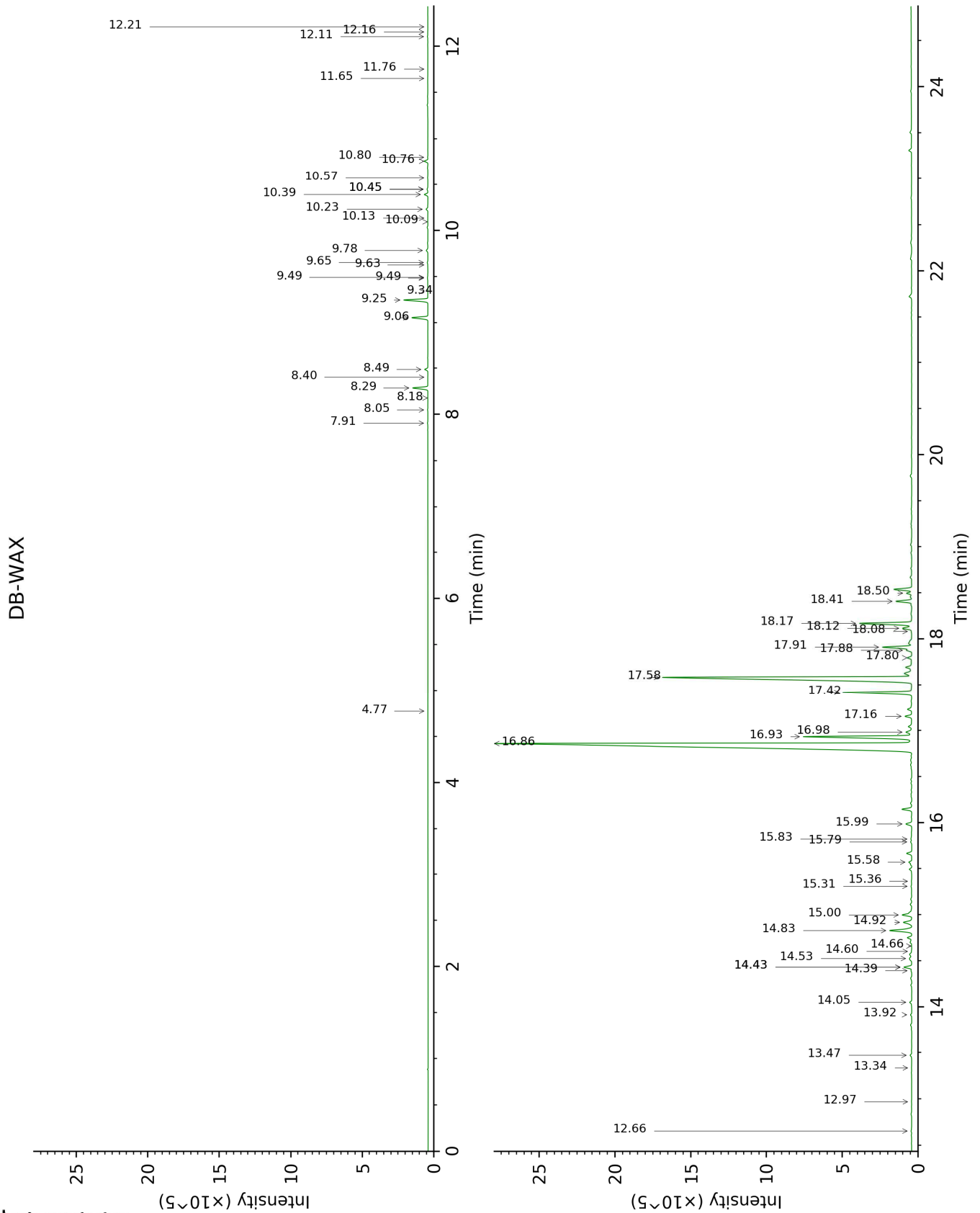Note: no correction factor was applied

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

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DB-WAX

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FULL ANALYSIS DATA

Identification	Column DB-5			Column DB-WAX		
	R.T	R.I	%	R.T	R.I	%
4-Methylacetophenone	6.88	1179	0.03	10.57	1707	0.02
Dihydroalbene	6.99	1186	tr	4.77	1269	tr
Unknown [m/z 93, 91 (89), 94 (85), 105 (60)... 176? (10)]	7.46	1217	0.01	9.34	1607	0.01
Teresantalic acid	8.39	1281	0.04	15.80	2187	0.06
Unknown [m/z 121, 93 (77), 79 (43), 91 (43), 145 (35)... 178 (8)]	8.97	1322	tr			
Unknown [m/z 112, 97 (31), 43 (29), 109 (22), 67 (16)...]	9.09	1331	tr			
Tricycloekasantalal	9.17	1337	0.05	10.45*	1697	0.05
(1S,5S,6R)-2,6-Dimethylbicyclo[3.1.1]hept-2-ene-6-propanal?	9.39	1354	0.01	10.45*	1697	[0.05]
Unknown [m/z 93, 160 (81), 91 (58), 94 (53), 134 (53)...]	9.57	1359	0.04			
7-epi-Sesquithujene	9.98	1388	tr	7.91	1497	0.02
γ-4-Dimethylbenzenebutyral	10.12	1398	0.02			
α-Cedrene	10.21*	1404	0.02	8.05	1508	0.02
Sesquithujene	10.21*	1404	[0.02]	8.18	1518	tr
β-Cedrene	10.33	1413	0.01	8.40	1535	tr
α-Santalene	10.39	1418	0.82	8.29	1526	0.80
trans-α-Bergamotene	10.61	1434	0.18	8.49	1541	0.16
Unknown [m/z 93, 91 (80), 79 (68), 123 (68), 121 (56)... 204 (3)]	10.68	1439	0.01			
epi-β-Santalene	10.75	1445	0.88	9.06	1585	0.86
α-Acoradiene	10.86*	1452	0.02	9.49	1619	0.01
Geranylacetone	10.86*	1452	[0.02]	11.76	1808	tr
(E)-β-Farnesene	10.93*	1458	1.32	9.65	1633	0.03
β-Santalene	10.93*	1458	[1.32]	9.25	1600	1.29
Unknown [m/z 135, 119 (34), 107 (25), 91 (20), 93 (19)...]	10.98*	1461	0.04			
β-Acoradiene	10.98*	1461	[0.04]	9.49	1620	0.01
10-epi-β-Acoradiene	11.04	1466	0.01	9.63	1631	tr
γ-Curcumene	11.20	1478	0.09	9.78	1643	0.10
ar-Curcumene	11.24	1481	0.23	10.76	1723	0.19
α-Selinene	11.35	1489	tr	10.13	1671	0.01
Unknown [m/z 119, 105 (51), 91 (31), 132 (30), 121 (26), 145 (23), 134 (20)... 204 (2)]	11.37	1491	0.01	12.21	1848	0.01
α-Alaskene	11.56	1504	0.01	10.09	1668	0.01
β-Bisabolene	11.59	1507	0.09	10.23	1679	0.10
β-Curcumene	11.63	1510	0.22	10.39	1692	0.18
Unknown [m/z 121, 93 (56),	11.70	1515	0.09	13.47	1962	0.09

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91 (12), 94 (11), 122 (10)...220]						
β-Sesquiphellandrene	11.77	1521	0.02	10.80	1727	0.01
8,14-Cedranoxide	11.91	1532	0.02	11.65	1799	0.01
Unknown [m/z 121, 93 (91), 79 (57), 91 (25), 43 (23), 77 (18)...202 (8)]	11.98	1538	0.11	14.05	2016	0.11
Unknown [m/z 121, 93 (79), 79 (51), 91 (21), 77 (16), 43 (15)...202 (5)]	12.14	1550	0.05			
(*E*)-Nerolidol	12.31	1564	0.07	13.92	2003	0.06
Unknown [m/z 43, 125 (78), 107 (43), 132 (34), 67 (31)... 220 (3)]	12.39*	1570	0.03	12.11	1839	0.02
Unknown [m/z 43, 125 (91), 107 (39), 41 (24), 67 (24), 93 (21)... 220 (4)]	12.39*	1570	[0.03]	12.16	1843	0.02
Dendrolasin	12.43	1573	0.05	12.66	1887	0.03
Helifolen-12-al A	12.66	1591	0.01	12.97	1916	0.01
α-Cedrol	12.67	1592	0.01	14.39	2049	0.04
Helifolen-12-al B	12.76	1599	0.03	13.34	1949	0.01
Unknown [m/z 81, 41 (40), 69 (36), 138 (27), 43 (26), 110 (25)... 222 (1)]	12.86	1607	0.10			
Rosifoliol	13.00	1618	0.04	14.43*	2053	0.44
α-Acorenol	13.04	1621	0.02	14.60	2069	0.02
β-Acorenol	13.08	1625	0.15	15.00	2108	0.68
10-epi-β-Acorenol?	13.27	1641	0.03			
Unknown [m/z 91, 43 (89), 93 (84), 81 (81), 105 (79), 79 (70), 67 (68), 41 (68)...]	13.31*	1644	0.54			
β-Eudesmol	13.31*	1644	[0.54]	15.58	2165	0.15
α-Bisabolol oxide B, epimer 1	13.40	1652	0.34	14.52	2062	0.20
α-Bisabolol oxide B, epimer 2	13.43	1654	0.05	14.66	2074	0.01
Unknown [m/z 93, 121 (97), 91 (30), 92 (27), 79 (26), 94 (21), 105 (19), 122 (18)... 222 (9)]	13.50*	1659	0.97			
Unknown [m/z 121, 93 (96), 95 (96), 41 (65), 82 (63), 69 (62), 67 (59)... 222 (8)]	13.50*	1659	[0.97]	14.43*	2053	[0.44]
Bulnesol	13.50*	1659	[0.97]	15.36	2144	0.02
β-Bisabolol	13.57†	1666	49.66	14.83	2091	1.42
epi-Cyclosantalal	13.61*†	1669	[49.66]			
(*E*)-α-Santalal	13.61*†	1669	[49.66]	14.92	2100	0.57
(*Z*)-α-Santalol	13.77†	1682	[49.66]	16.86	2298	46.26
(*Z*)-α-*trans*-Bergamotol	13.90	1693	5.98	16.93	2306	5.98
(*E*)-α-Santalol	13.93	1695	0.40	17.16	2330	0.36
Unknown [m/z 43, 93 (68), 41 (61), 69 (58), 125 (54),	14.02*	1703	4.35			

107 (50)...]						
(Z)-epi-β-Santalol	14.02*	1703	[4.35]	17.42	2358	3.86
(E)-α-*trans*-Bergamotol	14.09	1709	0.30	17.88	2408	0.24
Unknown [m/z 43, 189 (94), 81 (65), 93 (62), 95 (53), 119 (49)... 207 (43)...]	14.23*	1720	20.72	15.83	2190	0.07
(Z)-β-Santalol	14.23*	1720	[20.72]	17.58	2375	20.10
Unknown [m/z 119, 91 (31), 105 (29), 41 (25), 133 (23), 158 (21)...]	14.27*	1724	2.14	16.98	2311	0.40
(Z)-Nuciferol	14.27*	1724	[2.14]	18.41	2467	0.86
(E)-β-Santalol	14.42*	1737	2.50	17.91	2412	1.59
Unknown [m/z 91, 93 (65), 79 (57), 105 (49), 119 (47), 121 (44)...218 (1)]	14.42*	1737	[2.50]			
(2E,6E)-Farnesal	14.42*	1737	[2.50]	15.99	2207	0.36
(Z)-γ-Curcumen-12-ol	14.56	1750	0.44	17.80	2399	0.22
(Z)-β-Curcumen-12-ol	14.62	1754	0.65	18.12	2434	0.56
(Z)-Lanceol	14.69	1761	2.89	18.17	2440	2.83
(Z)-α-Santalyl acetate	14.84	1774	0.02	15.31	2138	0.03
Unknown [m/z 93, 119 (89), 91 (63), 79 (63), 132 (53), 41 (52)... 236 (3)]	14.88	1777	0.11	18.08	2431	0.02
Unknown [m/z 107, 93 (96), 79 (90), 55 (78), 41 (76)... 236 (6)]	14.99	1787	0.06			
Unknown [m/z 119, 93 (57), 84 (52), 79 (52), 107 (46), 91 (46)... 218 (1)]	15.04	1791	0.26	18.50	2477	0.27
Unknown [m/z 119, 105 (78), 145 (60), 91 (50), 121 (44), 93 (38)... 216 (7)]	15.20	1805	0.01			
Unknown [m/z 119, 43 (61), 132 (49), 105 (35), 141 (32)...]	15.46	1829	0.10			
Unknown [m/z 93, 43 (99), 109 (95), 68 (80), 95 (77), 81 (69), 110 (68)...220 (7)]	16.47	1922	0.02			
Unknown [m/z 93, 109 (98), 43 (97), 68 (83), 95 (74), 110 (72), 81 (71)...220 (8)]	16.54	1928	0.01			
Unknown [m/z 95, 109 (98), 43 (83), 93 (60), 41 (54), 67 (48), 81 (48)...220 (4)]	16.62	1936	0.01			
Unknown [m/z 43, 107 (24), 93 (23), 125 (23), 95 (23), 119 (23)...220 (1)]	16.67	1941	0.02			
Unknown [m/z 93, 94 (86), 91 (48), 121 (42), 79 (42), 107 (37)...218 (2)]	16.71	1945	0.11			
Total identified		**96.53%**			**90.89%**	

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| **Total reported** | **97.67%** | **91.89%** |

*: 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

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