

**Date :** March 07, 2022

**CERTIFICATE OF ANALYSIS – GC PROFILING**

*SAMPLE IDENTIFICATION*

**Internal code :** 22B22-NSO01


**Customer identification :** Sandalwood - Australia - APISO-210801SDSA

**Type :** Essential oil

**Source :** *Santalum album*

**Customer :** Natural Sourcing LLC

*ANALYSIS*

**Method:** PC-MAT-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 2014-005

**Analysis date :** March 03, 2022

Checked and approved by :

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Alexis St-Gelais, Ph. D., Chimiste 2013-174

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*PHYSICOCHEMICAL DATA*

**Physical aspect:** Faintly yellow viscous liquid

**Refractive index:**  $1.5066 \pm 0.0003$  (20 °C; method PC-MAT-016)

*CONCLUSION*

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

## ANALYSIS SUMMARY – CONSOLIDATED CONTENTS

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

Identification	%	Class
4-Methylacetophenone	0.03	Simple phenolic
Unknown	0.02	Terpene derivative
Teresantalic acid	0.01	Monoterpenic acid
Unknown	0.01	Terpenic aldehyde
Tricycloekasantalal	0.07	Terpenic aldehyde
Unknown	0.04	Unknown
7-epi-Sesquithujene	0.02	Sesquiterpene
$\gamma$ -4-Dimethylbenzenebutyral	0.04	Simple phenolic
$\alpha$ -Cedrene	0.02	Sesquiterpene
Sesquithujene	0.01	Sesquiterpene
$\alpha$ -Santalene	1.03	Sesquiterpene
<i>trans</i> - $\alpha$ -Bergamotene	0.23	Sesquiterpene
epi- $\beta$ -Santalene	1.12	Sesquiterpene
$\beta$ -Santalene	1.61	Sesquiterpene
$\alpha$ -Acoradiene	0.01	Sesquiterpene
( <i>E</i> )- $\beta$ -Farnesene	0.04	Sesquiterpene
$\beta$ -Acoradiene	0.04	Sesquiterpene
Unknown	0.01	Unknown
10-epi- $\beta$ -Acoradiene	0.01	Sesquiterpene
$\gamma$ -Curcumene	0.11	Sesquiterpene
$\alpha$ -Curcumene	0.26	Sesquiterpene
Unknown	0.02	Sesquiterpene
$\beta$ -Bisabolene	0.12	Sesquiterpene
$\beta$ -Curcumene	0.23	Sesquiterpene
Unknown	0.06	Oxygenated sesquiterpene
$\beta$ -Sesquiphellandrene	0.02	Sesquiterpene
8,14-Cedranoxide	0.01	Sesquiterpenic ether
Unknown	0.09	Sesquiterpene
( <i>E</i> )- $\alpha$ -Bisabolene	0.02	Sesquiterpene
Unknown	0.08	Sesquiterpene
( <i>E</i> )-Nerolidol	0.09	Sesquiterpenic alcohol
Unknown	0.06	Oxygenated sesquiterpene
Unknown	0.04	Oxygenated sesquiterpene
Dendrolasin	0.03	Sesquiterpenic ether
Helifolen-12-al A	0.03	Sesquiterpenic aldehyde
Guaiol	0.03	Sesquiterpenic alcohol
Unknown	0.08	Oxygenated sesquiterpene
Rosifoliol	0.03	Sesquiterpenic alcohol
$\alpha$ -Acorenol	0.03	Sesquiterpenic alcohol
$\beta$ -Acorenol	0.15	Sesquiterpenic alcohol
10-epi- $\beta$ -Acorenol?	0.03	Sesquiterpenic alcohol
Unknown	0.59	Oxygenated sesquiterpene
$\beta$ -Eudesmol	0.05	Sesquiterpenic alcohol
$\alpha$ -Bisabolol oxide B, epimer 1	0.24	Sesquiterpenic alcohol
$\alpha$ -Bisabolol oxide B, epimer 2	0.06	Sesquiterpenic alcohol

Bulnesol	0.03	Sesquiterpenic alcohol
Unknown	0.38	Oxygenated sesquiterpene
Unknown	0.65	Oxygenated sesquiterpene
Unknown	0.59	Oxygenated sesquiterpene
epi-Cyclosantalal	0.37	Sesquiterpenic aldehyde
β-Bisabolol	0.61	Sesquiterpenic alcohol
(E)-α-Santalal	1.47	Sesquiterpenic aldehyde
(Z)-α-Santalol	45.07	Sesquiterpenic alcohol
(Z)-α-trans-Bergamotol	5.77	Sesquiterpenic alcohol
(E)-α-Santalol	0.37	Sesquiterpenic alcohol
Unknown	0.16	Oxygenated sesquiterpene
(Z)-epi-β-Santalol	4.06	Sesquiterpenic alcohol
(E)-α-trans-Bergamotol	0.31	Sesquiterpenic alcohol
(Z)-β-Santalol	19.60	Sesquiterpenic alcohol
Unknown	0.42	Oxygenated sesquiterpene
(Z)-Nuciferol	1.33	Sesquiterpenic alcohol
(Z)-γ-Curcumen-12-ol	0.55	Sesquiterpenic alcohol
(E)-β-Santalol	1.75	Sesquiterpenic alcohol
(2E,6E)-Farnesal	0.33	Sesquiterpenic aldehyde
Unknown	1.16	Oxygenated sesquiterpene
Unknown	0.24	Oxygenated sesquiterpene
Santalol isomer II	0.33	Sesquiterpenic alcohol
Curcumen-12-ol analog	0.22	Sesquiterpenic alcohol
(Z)-β-Curcumen-12-ol	0.77	Sesquiterpenic alcohol
(Z)-Lanceol	2.62	Sesquiterpenic alcohol
(Z)-α-Santalyl acetate	0.09	Sesquiterpenic ester
Unknown	0.06	Unknown
Unknown	0.23	Oxygenated sesquiterpene
Bisabola-2,7(Z),10(Z)-trien-13-ol?	0.04	Oxygenated sesquiterpene
Unknown	0.04	Oxygenated sesquiterpene
Unknown	0.05	Oxygenated sesquiterpene
Unknown	0.03	Oxygenated sesquiterpene
Unknown	0.02	Oxygenated sesquiterpene
Unknown	0.02	Oxygenated sesquiterpene
<b>Consolidated total</b>	<b>96.65%</b>	

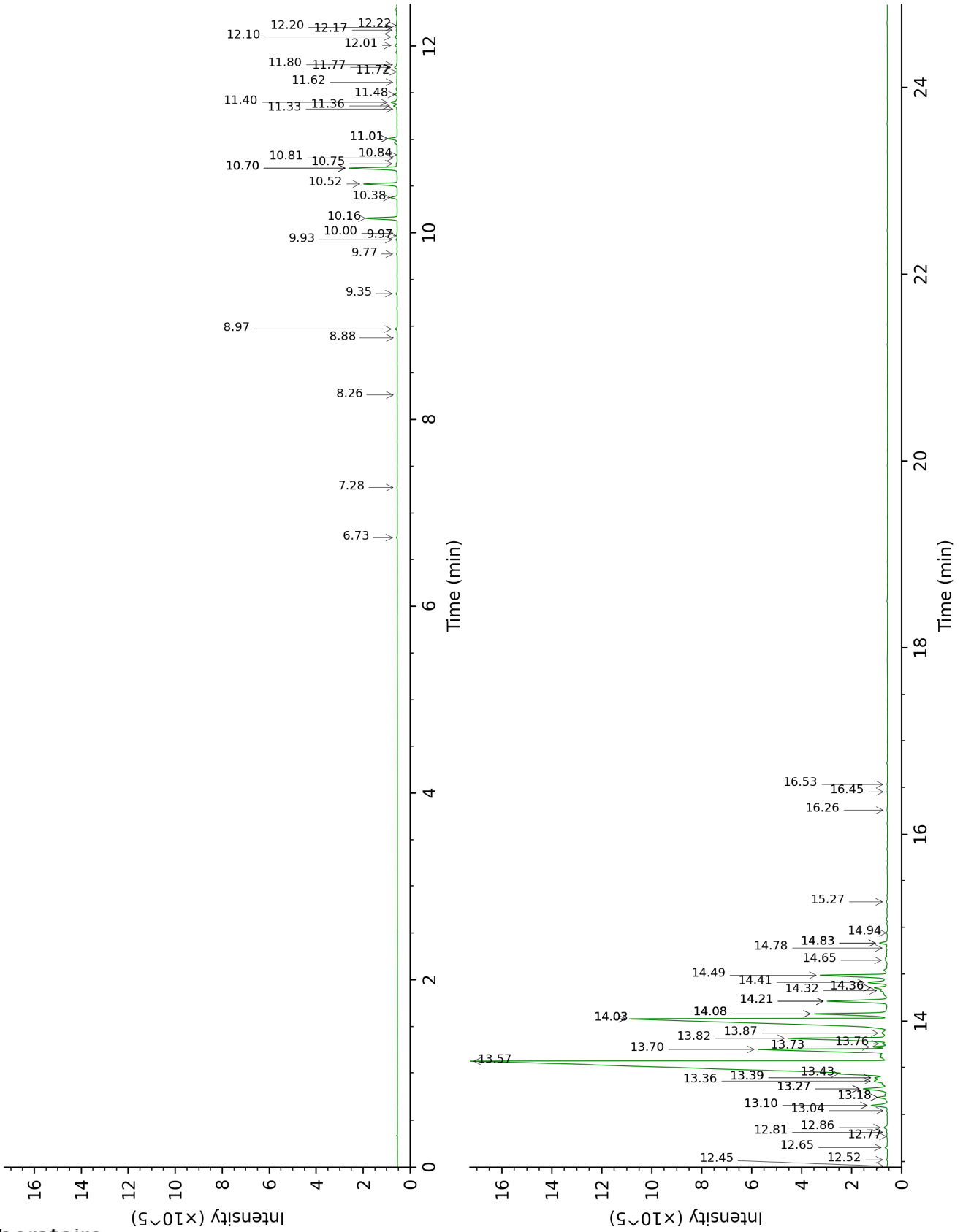
Note: no correction factor was applied

**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.

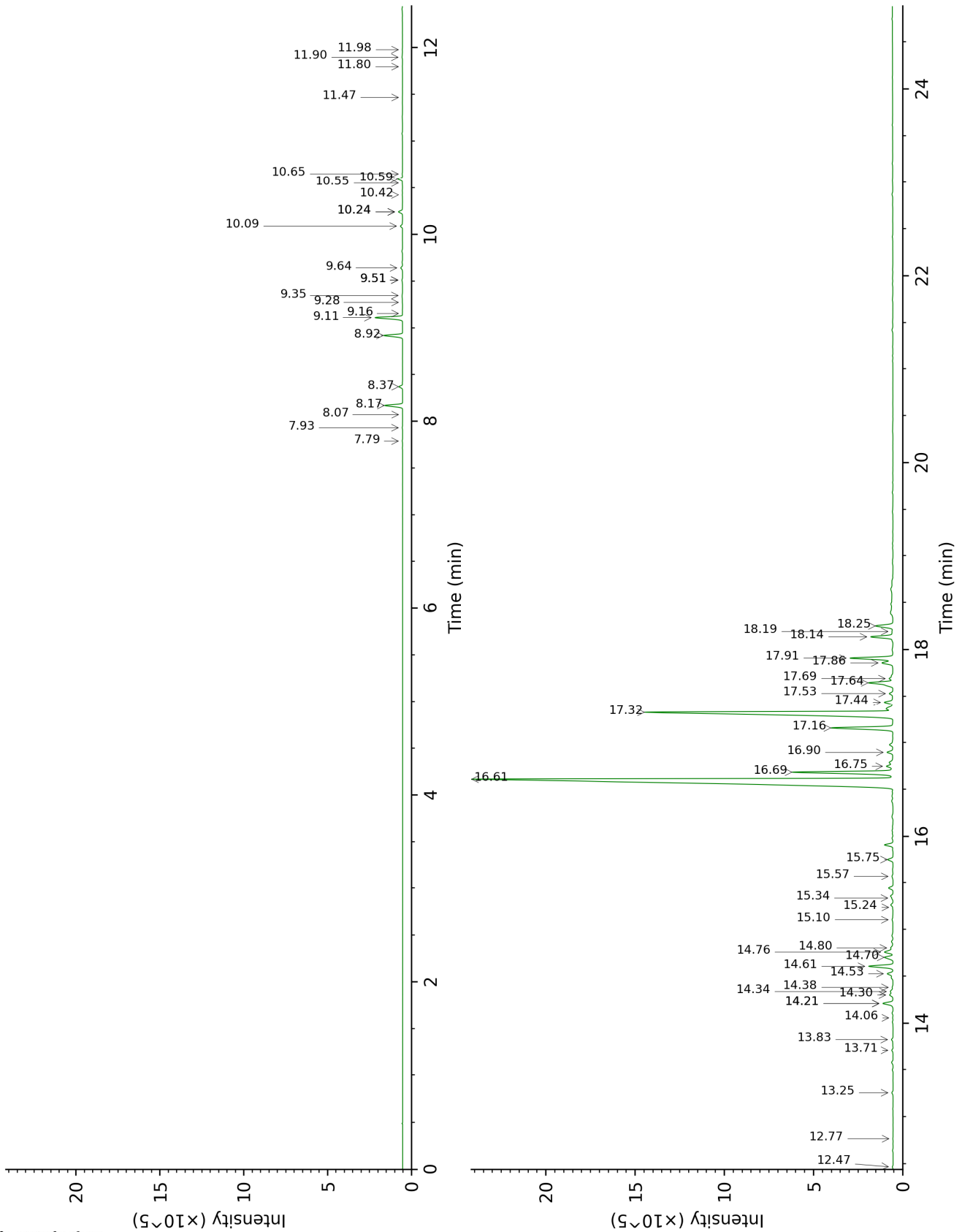
**Unknowns:** Unknown compounds' mass spectral data is presented in the "Full analysis data" table. The occurrence of unknown compounds is to be expected in many samples, and does not denote particular problems unless noted otherwise in the conclusion.

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

DB-5



DB-WAX



FULL ANALYSIS DATA

Identification	Column DB-5			Column DB-WAX		
	R.T	R.I	%	R.T	R.I	%
4-Methylacetophenone	6.73	1180	0.03	10.42	1709	0.02
Unknown [m/z 93, 91 (89), 94 (85), 105 (60)... 176? (10)]	7.28	1215	0.02	9.16	1606	0.01
Teresantalic acid	8.26	1281	0.01	15.57	2187	0.08
Unknown [m/z 121, 93 (77), 79 (43), 91 (43), 145 (35)... 178 (8)]	8.88	1324	0.01			
Tricycloekasantalal	8.97	1330	0.07	10.24*	1694	0.26
Unknown [m/z 93, 160 (81), 91 (58), 94 (53), 134 (53)...]	9.35	1357	0.04			
7-epi-Sesquithujene	9.77	1387	0.02	7.79	1500	0.02
γ-4-Dimethylbenzenebutyral	9.93	1398	0.04			
α-Cedrene	9.97	1401	0.02	7.93	1511	0.02
Sesquithujene	10.00	1403	0.01	8.07	1522	0.01
α-Santalene	10.16	1414	1.03	8.17	1529	1.02
trans-α-Bergamotene	10.38	1431	0.23	8.37	1545	0.20
epi-β-Santalene	10.52	1442	1.12	8.92	1588	1.08
β-Santalene	10.70*	1455	1.66	9.11	1602	1.61
α-Acoradiene	10.70*	1455	[1.66]	9.28	1616	0.01
(E)-β-Farnesene	10.70*	1455	[1.66]	9.51*	1635	0.05
β-Acoradiene	10.75	1458	0.04	9.35	1622	0.05
Unknown [m/z 135, 119 (34), 107 (25), 91 (20), 93 (19)...]	10.81	1463	0.01			
10-epi-β-Acoradiene	10.84	1466	0.01	9.51*	1635	[0.05]
γ-Curcumene	11.01*†	1478	0.40	9.64	1645	0.11
ar-Curcumene	11.01*†	1478	[0.40]	10.59	1724	0.26
Unknown [m/z 119, 91 (14), 120 (10), 117 (9)... 200? (2)]	11.33	1502	0.02	11.80	1827	0.01
β-Bisabolene	11.36	1504	0.12	10.09	1682	0.13
β-Curcumene	11.40	1508	0.23	10.24*	1694	[0.26]
Unknown [m/z 121, 93 (56), 91 (12), 94 (11), 122 (10)...220]	11.48	1514	0.06	13.25	1960	0.08
β-Sesquiphellandrene	11.62	1524	0.02	10.55	1720	0.02
8,14-Cedranoxide	11.72	1533	0.01	11.47	1798	0.01
Unknown [m/z 121, 93 (91), 79 (57), 91 (25), 43 (23), 77 (18)...202 (8)]	11.77	1537	0.09	13.83	2014	0.10
(E)-α-Bisabolene	11.80	1539	0.02	10.65	1729	0.02
Unknown [m/z 121, 93 (79), 79 (51), 91 (21), 77 (16), 43 (15)...202 (5)]	12.01	1555	0.08			
(E)-Nerolidol	12.10	1562	0.09	13.71	2002	0.08



Unknown [m/z 43, 125 (78), 107 (43), 132 (34), 67 (31)... 220 (3)]	12.17	1568	0.06	11.90	1836	0.04
Unknown [m/z 43, 125 (91), 107 (39), 41 (24), 67 (24), 93 (21)... 220 (4)]	12.20	1570	0.04	11.98	1843	0.01
Dendrolasin	12.22	1572	0.03	12.47	1887	0.05
Helifolen-12-al A	12.45	1590	0.03	12.77	1914	0.02
Guaiol	12.52	1596	0.03	14.06	2036	0.03
Unknown [m/z 81, 41 (40), 69 (36), 138 (27), 43 (26), 110 (25)... 222 (1)]	12.65	1606	0.08			
Rosifoliol	12.77	1616	0.03	14.21*	2051	0.69
$\alpha$ -Acorenol	12.81	1620	0.03	14.34	2063	0.20
$\beta$ -Acorenol	12.86	1624	0.15	14.80	2109	0.16
10-epi- $\beta$ -Acorenol?	13.04	1638	0.03			
Unknown [m/z 91, 43 (89), 93 (84), 81 (81), 105 (79), 79 (70), 67 (68), 41 (68)...]	13.10*	1643	0.64			
$\beta$ -Eudesmol	13.10*	1643	[0.64]	15.34	2163	0.05
$\alpha$ -Bisabolol oxide B, epimer 1	13.18*	1650	0.33	14.30	2060	0.24
$\alpha$ -Bisabolol oxide B, epimer 2	13.18*	1650	[0.33]	14.38	2068	0.06
Bulnesol	13.27*	1658	1.06	15.24	2153	0.03
Unknown [m/z 93, 121 (97), 91 (30), 92 (27), 79 (26), 94 (21), 105 (19), 122 (18)... 222 (9)]	13.27*	1658	[1.06]			
Unknown [m/z 121, 93 (96), 95 (96), 41 (65), 82 (63), 69 (62), 67 (59)... 222 (8)]	13.27*	1658	[1.06]	14.21*	2051	[0.69]
Unknown [m/z 67, 119 (70), 82 (42), 91 (37), 95 (36), 121 (34), 93 (32)...]	13.36†	1664	1.17	14.70	2099	0.59
epi-Cyclosantalal	13.39*†	1667	[1.17]	14.53	2082	0.37
$\beta$ -Bisabolol	13.39*†	1667	[1.17]	14.76	2104	0.61
( <i>E</i> )- $\alpha$ -Santalal	13.43†	1671	47.29	14.61	2090	1.47
( <i>Z</i> )- $\alpha$ -Santalol	13.57†	1682	[47.29]	16.61	2296	45.07
( <i>Z</i> )- $\alpha$ - <i>trans</i> -Bergamotol	13.70	1693	5.77	16.69	2303	5.81
( <i>E</i> )- $\alpha$ -Santalol	13.73	1695	0.37	16.90	2326	0.36
Unknown [m/z 43, 93 (68), 41 (61), 69 (58), 125 (54), 107 (50)...]	13.76	1698	0.16			
( <i>Z</i> )-epi- $\beta$ -Santalol	13.82	1703	4.06	17.16	2355	3.70
( <i>E</i> )- $\alpha$ - <i>trans</i> -Bergamotol	13.87	1707	0.31	17.69	2414	0.23
( <i>Z</i> )- $\beta$ -Santalol	14.02*	1721	20.30	17.32	2373	19.60
Unknown [m/z 119, 91 (31), 105 (29), 41 (25), 133 (23), 158 (21)...]	14.02*	1721	[20.30]	16.75	2310	0.42

(Z)-Nuciferol	14.08*	1725	2.87	18.14	2465	1.33
(Z)-γ-Curcumen-12-ol	14.08*	1725	[2.87]	17.44	2386	0.55
(E)-β-Santalol	14.21*	1737	2.36	17.64	2409	1.75
(2E,6E)-Farnesal	14.21*	1737	[2.36]	15.75	2205	0.33
Unknown [m/z 91, 93 (65), 79 (57), 105 (49), 119 (47), 121 (44)...218 (1)]	14.21*	1737	[2.36]	18.25	2478	1.16
Unknown [m/z 93, 121 (57), 91 (46), 138 (39), 119 (38), 109 (37)...]	14.32	1747	0.24			
Santalol isomer II	14.36*	1749	0.54			
Curcumen-12-ol analog	14.36*	1749	[0.54]	17.53	2396	0.22
(Z)-β-Curcumen-12-ol	14.41	1754	0.77	17.86	2433	0.73
(Z)-Lanceol	14.49	1761	2.62	17.91	2439	2.47
(Z)-α-Santalyl acetate	14.65	1775	0.09	15.10	2139	0.08
Unknown [m/z 159, 43 (40), 202 (21), 91 (19), 79 (18), 131 (17)...]	14.78	1786	0.06			
Unknown [m/z 107, 93 (96), 79 (90), 55 (78), 41 (76)... 236 (6)]	14.83*	1791	0.27			
Bisabola-2,7(Z),10(Z)-trien-13-ol?	14.83*	1791	[0.27]	18.19	2471	0.04
Unknown [m/z 119, 105 (78), 145 (60), 91 (50), 121 (44), 93 (38)... 216 (7)]	14.94	1800	0.04			
Unknown [m/z 119, 43 (61), 132 (49), 105 (35), 141 (32)...]	15.27	1830	0.05			
Unknown [m/z 93, 43 (99), 109 (95), 68 (80), 95 (77), 81 (69), 110 (68)...220 (7)]	16.26	1921	0.03			
Unknown [m/z 43, 107 (24), 93 (23), 125 (23), 95 (23), 119 (23)...220 (1)]	16.46	1940	0.02			
Unknown [m/z 93, 94 (86), 91 (48), 121 (42), 79 (42), 107 (37)...218 (2)]	16.53	1947	0.02			
<b>Total identified</b>		<b>95.17%</b>			<b>91.28%</b>	
<b>Total reported</b>		<b>97.45%</b>			<b>93.70%</b>	

\*: 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

Note: no correction factor was applied

R.T.: Retention time (minutes)

R.I.: Retention index