

**Date :** March 16, 2021

**CERTIFICATE OF ANALYSIS – GC PROFILING**

*SAMPLE IDENTIFICATION*

**Internal code :** 21B23-FEP27

**Customer identification :** Sandalwood - India - 51298-05

**Type :** Essential oil

**Source :** *Santalum album*

**Customer :** Fern & Petal

*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 :** Alexis St-Gelais, M. Sc., chimiste

**Analysis date :** March 16, 2021

Checked and approved by :

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

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*PHYSICOCHEMICAL DATA*

**Physical aspect:** Faintly yellow viscous liquid

**Refractive index:**  $1.5063 \pm 0.0003$  (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
Santene	0.03	Normonoterpene
Tricyclene	0.01	Monoterpene
Camphene	tr	Monoterpene
Limonene	0.01	Monoterpene
4-Methylacetophenone	0.02	Simple phenolic
Dihydroalbene	0.01	Terpene derivative
Unknown	0.03	Terpene derivative
Teresantalic acid	0.20	Monoterpenic acid
Tricycloekasantalal	0.18	Terpenic aldehyde
(1S,5S,6R)-2,6-Dimethylbicyclo[3.1.1]hept-2-ene-6-propanal?	0.03	Terpenic aldehyde
Unknown	0.05	Unknown
7-epi-Sesquithujene	0.02	Sesquiterpene
γ-4-Dimethylbenzenebutyral	0.03	Simple phenolic
α-Cedrene	0.07	Sesquiterpene
α-Santalene	0.92	Sesquiterpene
trans-α-Bergamotene	0.18	Sesquiterpene
Unknown	0.01	Sesquiterpene
epi-β-Santalene	0.91	Sesquiterpene
β-Santalene	1.44	Sesquiterpene
β-Acoradiene	0.04	Sesquiterpene
α-Curcumene	0.32	Sesquiterpene
γ-Curcumene	0.03	Sesquiterpene
Unknown	0.01	Sesquiterpene
α-Alaskene	0.05	Sesquiterpene
β-Bisabolene	0.06	Sesquiterpene
β-Curcumene	0.13	Sesquiterpene
Unknown	0.54	Oxygenated sesquiterpene
β-Sesquiphellandrene	0.02	Sesquiterpene
Unknown	0.35	Sesquiterpene
Unknown	0.19	Sesquiterpene
(E)-Nerolidol	0.06	Sesquiterpenic alcohol
Unknown	0.05	Oxygenated sesquiterpene
Dendrolasin	0.08	Sesquiterpenic ether
Guaiol	0.11	Sesquiterpenic alcohol
Unknown	0.13	Oxygenated sesquiterpene
Rosifoliol	0.04	Sesquiterpenic alcohol
α-Acorenol	0.07	Sesquiterpenic alcohol
β-Acorenol	0.21	Sesquiterpenic alcohol
10-epi-β-Acorenol?	0.04	Sesquiterpenic alcohol
Unknown	0.49	Oxygenated sesquiterpene
β-Eudesmol	0.13	Sesquiterpenic alcohol
α-Bisabolol oxide B, epimer 1	0.22	Sesquiterpenic alcohol
α-Bisabolol oxide B, epimer 2	0.17	Sesquiterpenic alcohol
Unknown	0.44	Oxygenated sesquiterpene

Unknown	0.71	Oxygenated sesquiterpene
Bulnesol	0.20	Sesquiterpenic alcohol
β-Bisabolol	0.42	Sesquiterpenic alcohol
epi-Cyclosantalal	0.33	Sesquiterpenic aldehyde
(Z)-α-Santalol	43.35	Sesquiterpenic alcohol
(E)-α-Santalol	1.78	Sesquiterpenic aldehyde
(Z)-α-trans-Bergamotol	6.11	Sesquiterpenic alcohol
(E)-α-Santalol	0.46	Sesquiterpenic alcohol
(Z)-epi-β-Santalol	4.10	Sesquiterpenic alcohol
(E)-α-trans-Bergamotol	0.42	Sesquiterpenic alcohol
(Z)-β-Santalol	19.08	Sesquiterpenic alcohol
Unknown	0.17	Oxygenated sesquiterpene
(Z)-Nuciferol	0.95	Sesquiterpenic alcohol
(E)-β-Santalol	1.64	Sesquiterpenic alcohol
Unknown	0.95	Oxygenated sesquiterpene
(2E,6E)-Farnesal	0.34	Sesquiterpenic aldehyde
(Z)-β-Curcumen-12-ol	0.77	Sesquiterpenic alcohol
Curcumen-12-ol analog	0.21	Sesquiterpenic alcohol
(Z)-Lanceol	1.84	Sesquiterpenic alcohol
(Z)-α-Santalyl acetate	0.19	Sesquiterpenic ester
Unknown	0.06	Oxygenated sesquiterpene
Unknown	0.22	Oxygenated sesquiterpene
Bisabola-2,7(Z),10(Z)-trien-13-ol?	0.14	Oxygenated sesquiterpene
Unknown	0.04	Oxygenated sesquiterpene
Unknown	0.23	Oxygenated sesquiterpene
Unknown	0.02	Oxygenated sesquiterpene
Unknown	0.01	Oxygenated sesquiterpene
Unknown	0.03	Oxygenated sesquiterpene
Unknown	0.12	Oxygenated sesquiterpene
<b>Consolidated total</b>	<b>93.05%</b>	

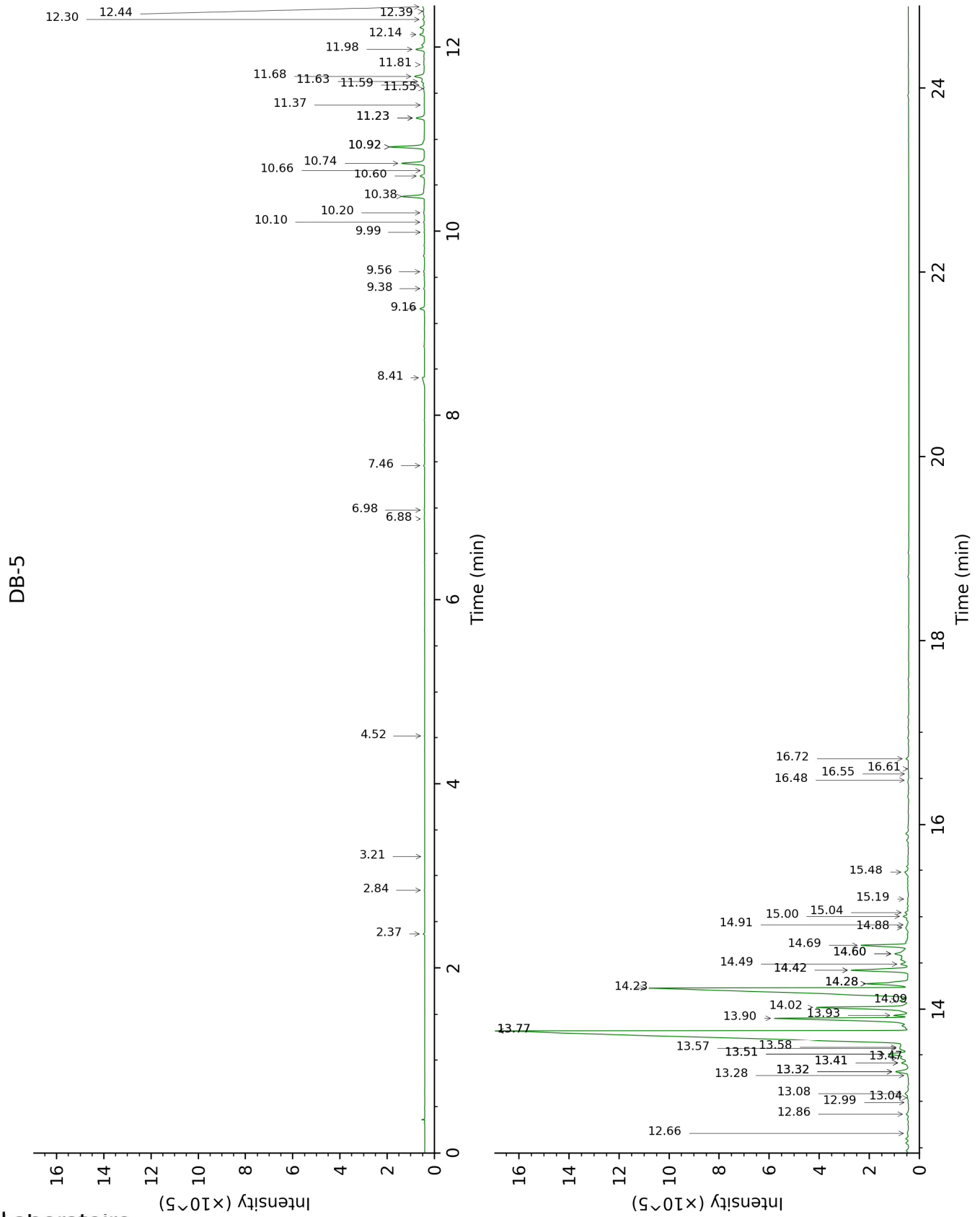
tr: The compound has been detected below 0.005% of total signal.

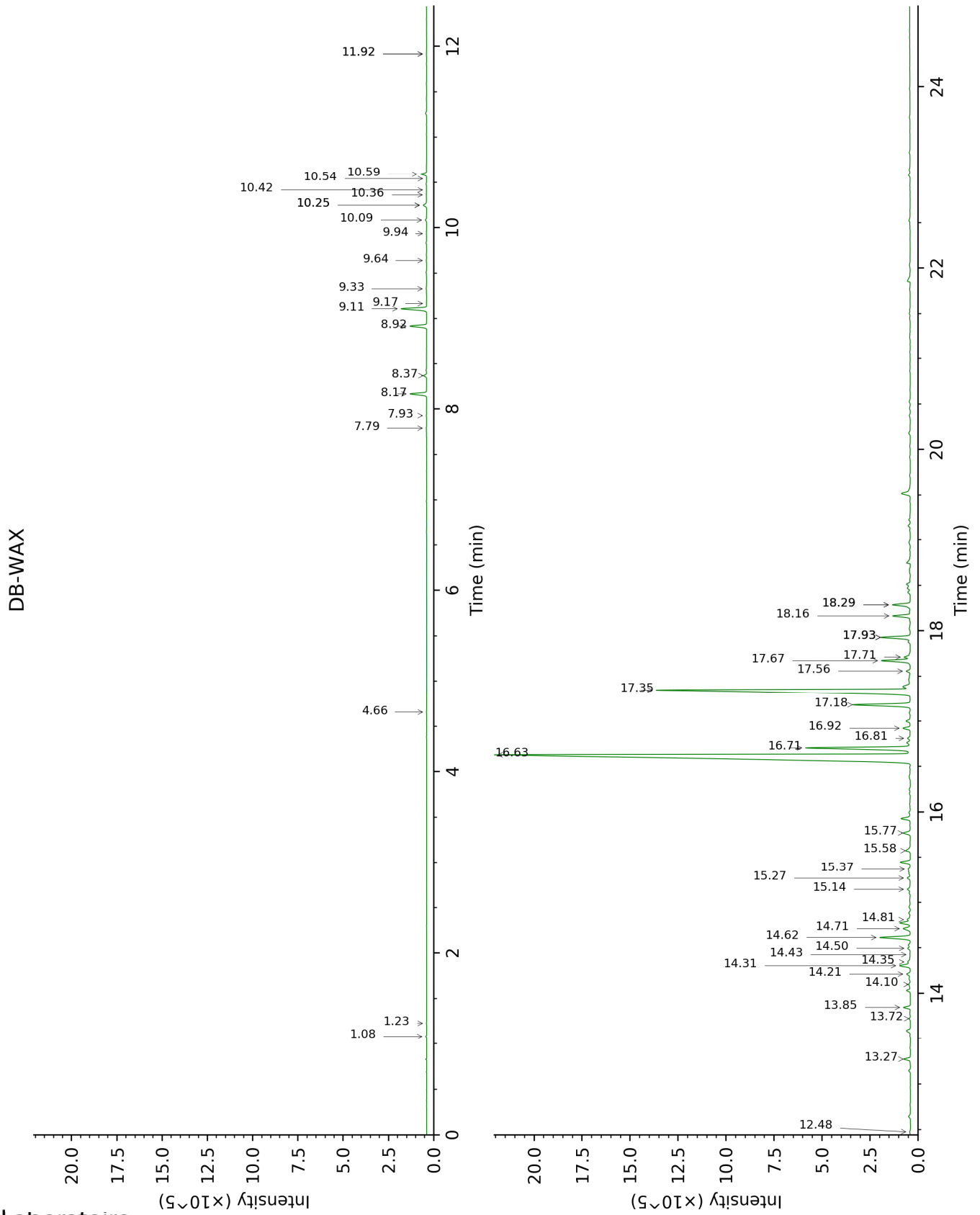
Note: no correction factor was applied

**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.

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





FULL ANALYSIS DATA

Identification	Column DB-5			Column DB-WAX		
	R.T	R.I	%	R.T	R.I	%
Santene	2.37	882	0.03	1.08	948	0.03
Tricyclene	2.84	918	0.01	1.23	972	0.01
Camphene	3.22	942	tr			
Limonene	4.52	1028	0.01			
4-Methylacetophenone	6.88	1178	0.02	10.42	1708	0.01
Dihydroalbene	6.98	1185	0.01	4.66	1269	0.02
Unknown [m/z 93, 91 (89), 94 (85), 105 (60)... 176? (10)]	7.46	1216	0.03	9.17	1606	0.01
Teresantalic acid	8.41	1281	0.20	15.58	2184	0.33
Tricycloekasantalal	9.16	1329	0.18	10.25*	1694	0.24
(1S,5S,6R)-2,6-Dimethylbicyclo[3.1.1]hept-2-ene-6-propanal?	9.38	1345	0.03	10.36	1704	0.06
Unknown [m/z 93, 160 (81), 91 (58), 94 (53), 134 (53)...]	9.56	1358	0.05			
7-epi-Sesquithujene	9.99	1388	0.02	7.79	1499	0.02
γ-4-Dimethylbenzenebutyral	10.10	1395	0.03			
α-Cedrene	10.20	1402	0.07	7.93	1509	0.02
α-Santalene	10.38	1416	0.92	8.17	1528	0.91
trans-α-Bergamotene	10.60	1432	0.18	8.37	1544	0.15
Unknown [m/z 93, 91 (80), 79 (68), 123 (68), 121 (56)... 204 (3)]	10.66	1437	0.01			
epi-β-Santalene	10.74	1443	0.91	8.92	1587	0.93
β-Santalene	10.92*	1456	1.45	9.11	1602	1.44
β-Acoradiene	10.92*	1456	[1.45]	9.33	1619	0.04
ar-Curcumene	11.23*	1479	0.35	10.59	1723	0.32
γ-Curcumene	11.23*	1479	[0.35]	9.64	1645	0.03
Unknown [m/z 119, 105 (51), 91 (31), 132 (30), 121 (26), 145 (23), 134 (20)... 204 (2)]	11.37	1490	0.01	11.92*	1837	0.03
α-Alaskene	11.55	1503	0.05	9.94	1669	0.03
β-Bisabolene	11.59	1506	0.06	10.08	1681	0.07
β-Curcumene	11.63	1509	0.13	10.25*	1694	[0.24]
Unknown [m/z 121, 93 (56), 91 (12), 94 (11), 122 (10)...220]	11.68	1513	0.54	13.27	1962	0.40
β-Sesquiphellandrene	11.81	1523	0.02	10.54	1719	0.01
Unknown [m/z 121, 93 (91), 79 (57), 91 (25), 43 (23), 77 (18)...202 (8)]	11.98	1536	0.35	13.85	2015	0.37
Unknown [m/z 121, 93 (79), 79 (51), 91 (21), 77 (16), 43 (15)...202 (5)]	12.14	1549	0.19			
(E)-Nerolidol	12.30	1562	0.06	13.72	2003	0.07



Unknown [m/z 43, 125 (78), 107 (43), 132 (34), 67 (31)... 220 (3)]	12.39	1569	0.05	11.92*	1837	[0.03]
Dendrolasin	12.44	1572	0.08	12.48	1887	0.05
Guaiol	12.66	1590	0.11	14.10	2039	0.16
Unknown [m/z 81, 41 (40), 69 (36), 138 (27), 43 (26), 110 (25)... 222 (1)]	12.86	1606	0.13			
Rosifoliol	12.99	1616	0.04	14.21	2050	0.25
$\alpha$ -Acorenol	13.04	1620	0.07	14.43	2070	0.05
$\beta$ -Acorenol	13.08	1624	0.21	14.81	2107	0.21
10-epi- $\beta$ -Acorenol?	13.28	1640	0.04			
Unknown [m/z 91, 43 (89), 93 (84), 81 (81), 105 (79), 79 (70), 67 (68), 41 (68)...]	13.32*	1643	0.63			
$\beta$ -Eudesmol	13.32*	1643	[0.63]	15.37	2163	0.13
$\alpha$ -Bisabolol oxide B, epimer 1	13.41*	1651	0.32	14.35	2063	0.22
$\alpha$ -Bisabolol oxide B, epimer 2	13.41*	1651	[0.32]	14.50	2077	0.17
Unknown [m/z 93, 121 (97), 91 (30), 92 (27), 79 (26), 94 (21), 105 (19), 122 (18)... 222 (9)]	13.47	1656	0.44			
Unknown [m/z 121, 93 (96), 95 (96), 41 (65), 82 (63), 69 (62), 67 (59)... 222 (8)]	13.51*	1659	1.00	14.31	2059	0.71
Bulnesol	13.51*	1659	[1.00]	15.27	2153	0.20
$\beta$ -Bisabolol	13.57	1664	0.42	14.71	2098	0.51
epi-Cyclosantalal	13.58	1665	0.33			
(Z)- $\alpha$ -Santalol	13.76*	1680	45.92	16.63	2292	43.35
(E)- $\alpha$ -Santalol	13.76*	1680	[45.92]	14.62	2088	1.78
(Z)- $\alpha$ -trans-Bergamotol	13.90	1691	6.11	16.71	2300	5.98
(E)- $\alpha$ -Santalol	13.93	1694	0.46	16.92	2323	0.42
(Z)-epi- $\beta$ -Santalol	14.02	1701	4.10	17.18	2351	3.24
(E)- $\alpha$ -trans-Bergamotol	14.09	1707	0.42	17.71	2409	0.33
(Z)- $\beta$ -Santalol	14.23†	1719	22.02	17.35	2369	19.08
Unknown [m/z 119, 91 (31), 105 (29), 41 (25), 133 (23), 158 (21)...]	14.28*†	1723	[22.02]	16.81	2311	0.17
(Z)-Nuciferol	14.28*†	1723	[22.02]	18.16	2460	0.95
(E)- $\beta$ -Santalol	14.42*	1736	2.61	17.67	2404	1.64
Unknown [m/z 91, 93 (65), 79 (57), 105 (49), 119 (47), 121 (44)...218 (1)]	14.42*	1736	[2.61]	18.29*	2473	1.09
(2E,6E)-Farnesal	14.49	1742	0.34	15.77	2203	0.46
(Z)- $\beta$ -Curcumen-12-ol	14.60*	1751	0.98	17.93*	2433	1.64
Curcumen-12-ol analog	14.60*	1751	[0.98]	17.56	2392	0.21
(Z)-Lanceol	14.69	1759	1.84	17.93*	2433	[1.64]
(Z)- $\alpha$ -Santalyl acetate	14.88	1776	0.19	15.14	2141	0.23

Unknown [m/z 93, 119 (89), 91 (63), 79 (63), 132 (53), 41 (52)... 236 (3)]	14.91	1778	0.06	17.93*	2433	[1.64]
Unknown [m/z 107, 93 (96), 79 (90), 55 (78), 41 (76)... 236 (6)]	15.00	1786	0.22			
Bisabola-2,7(Z),10(Z)-trien-13-ol?	15.04	1790	0.14	18.29*	2473	[1.09]
Unknown [m/z 119, 105 (78), 145 (60), 91 (50), 121 (44), 93 (38)... 216 (7)]	15.19	1802	0.04			
Unknown [m/z 119, 43 (61), 132 (49), 105 (35), 141 (32)...]	15.48	1829	0.23			
Unknown [m/z 93, 43 (99), 109 (95), 68 (80), 95 (77), 81 (69), 110 (68)...220 (7)]	16.48	1920	0.02			
Unknown [m/z 93, 109 (98), 43 (97), 68 (83), 95 (74), 110 (72), 81 (71)...220 (8)]	16.55	1927	0.01			
Unknown [m/z 95, 109 (98), 43 (83), 93 (60), 41 (54), 67 (48), 81 (48)...220 (4)]	16.61	1932	0.03			
Unknown [m/z 43, 107 (24), 93 (23), 125 (23), 95 (23), 119 (23)...220 (1)]	16.72	1942	0.12			
<b>Total identified</b>		<b>93.12%</b>		<b>87.14%</b>		
<b>Total reported</b>		<b>95.65%</b>		<b>88.79%</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

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