

**Date :** September 13, 2022

**CERTIFICATE OF ANALYSIS – GC PROFILING (FULL TERPENES)**

*SAMPLE IDENTIFICATION*

**Internal code :** 22H31-NSO01

**Customer identification :** Essential oil : Palo Santo Fruit Lot # 007-2022

**Type :** Essential oil

**Source :** *Bursera graveolens*

**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 :** Amélie Simard, Analyste

**Analysis date :** September 07, 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:** Clear liquid

**Refractive index:**  $1.4746 \pm 0.0003$  (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
Toluene	0.01	Simple phenolic
$\alpha$ -Thujene	0.18	Monoterpene
$\alpha$ -Pinene	0.68	Monoterpene
3-Methylcyclohexanone	0.01	Aliphatic ketone
Camphene	0.03	Monoterpene
$\beta$ -Pinene	0.04	Monoterpene
Sabinene	0.21	Monoterpene
Myrcene	1.06	Monoterpene
Pseudolimonene	0.02	Monoterpene
$\alpha$ -Phellandrene	34.11	Monoterpene
$\Delta^3$ -Carene	0.03	Monoterpene
$\alpha$ -Terpinene	0.03	Monoterpene
para-Cymene	1.33	Monoterpene
Carvomenthene	0.01	Aliphatic alcohol
Limonene	50.82	Monoterpene
$\beta$ -Phellandrene	3.20	Monoterpene
(Z)- $\beta$ -Ocimene	0.02	Monoterpene
(E)- $\beta$ -Ocimene	0.02	Monoterpene
$\gamma$ -Terpinene	0.04	Monoterpene
Terpinolene	0.07	Monoterpene
Linalool	0.03	Monoterpenic alcohol
1,3,8-para-Menthatriene	0.02	Monoterpene
cis-para-Menth-2-en-1-ol	0.04	Monoterpenic alcohol
Limona ketone	0.02	Normonoterpenic ketone
cis-Limonene oxide	0.01	Monoterpenic ether
trans-Limonene oxide	0.01	Monoterpenic ether
trans-para-Menth-2-en-1-ol	0.02	Monoterpenic alcohol
Unknown	0.16	Oxygenated monoterpene
Menthone	0.02	Monoterpenic ketone
Menthofuran	3.81	Monoterpenic ether
Unknown	0.03	Oxygenated monoterpene
Terpinen-4-ol	0.04	Monoterpenic alcohol
trans-Isocarveol	0.02	Monoterpenic alcohol
$\alpha$ -Terpineol	0.05	Monoterpenic alcohol
cis- $\alpha$ -Phellandrene epoxide (iPr vs Me)	0.11	Monoterpenic ether
trans-Piperitol	0.02	Monoterpenic alcohol
Unknown	0.01	Oxygenated monoterpene
trans-Carveol	0.02	Monoterpenic alcohol
cis-para-Mentha-1(7),8-dien-2-ol	0.01	Monoterpenic alcohol
cis-Carveol	0.01	Monoterpenic alcohol
Pulegone	0.09	Monoterpenic ketone
Thymol methyl ether	0.05	Monoterpenic ether
Unknown	0.22	Unknown
Unknown	0.02	Unknown
Bornyl acetate	0.04	Monoterpenic ester

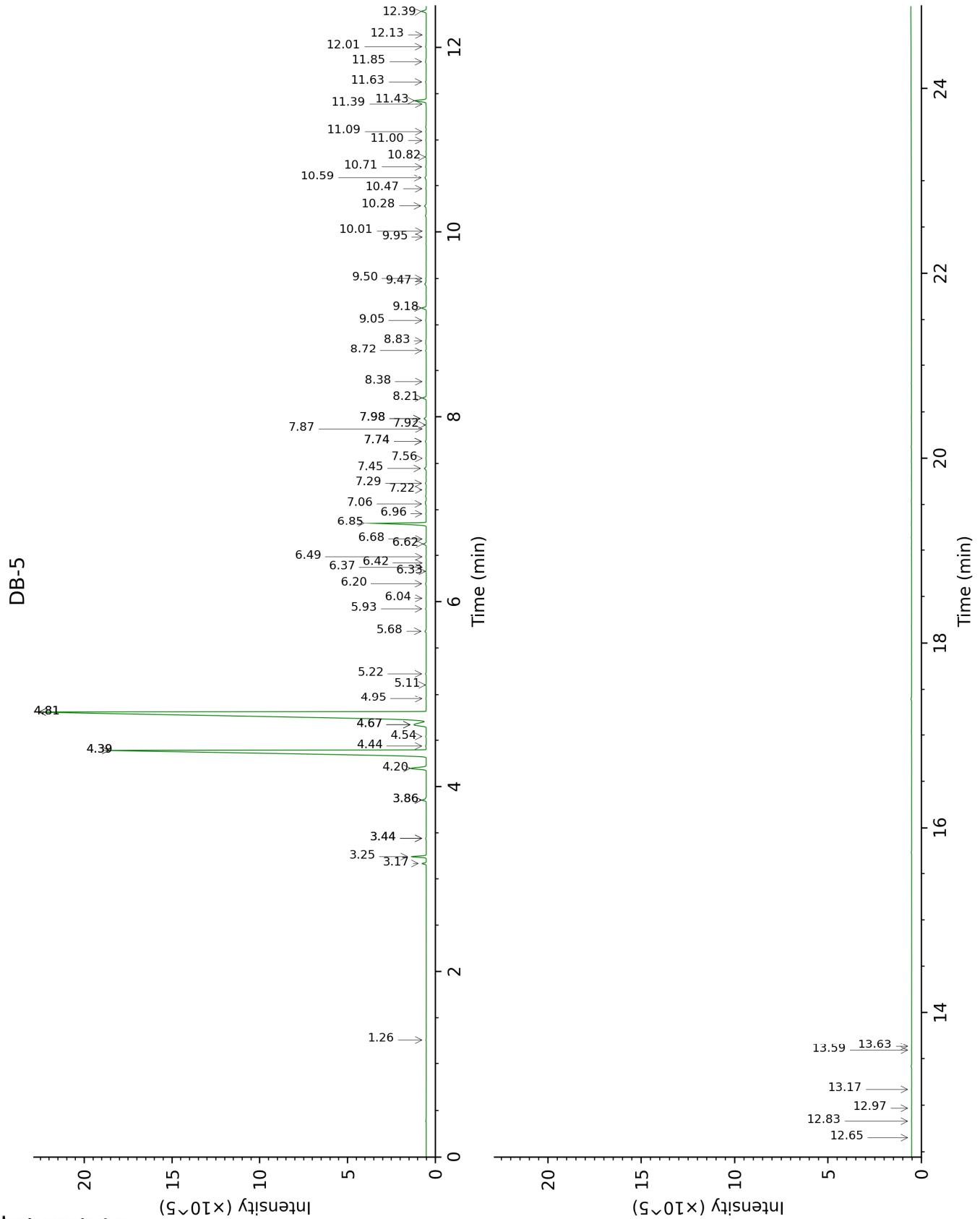
Unknown	0.03	Monoterpenic ester
para-Menth-5-en-1,2-diol isomer II	0.03	Monoterpenic alcohol
para-Menth-5-en-1,2-diol isomer III	0.27	Monoterpenic alcohol
Unknown	0.02	Unknown
Menthofurolactone isomer I	0.03	Monoterpenic lactone
α-Ylangene	0.01	Sesquiterpene
α-Copaene	0.01	Sesquiterpene
Unknown	0.11	Unknown
α-Cedrene	0.03	Sesquiterpene
Unknown	0.11	Unknown
β-Copaene	0.04	Sesquiterpene
γ-Elemene	0.03	Sesquiterpene
α-Humulene	0.02	Sesquiterpene
Unknown	0.02	Unknown
γ-Murolene	0.01	Sesquiterpene
Germacrene D	0.72	Sesquiterpene
Bicyclogermacrene	0.04	Sesquiterpene
γ-Cadinene	0.05	Sesquiterpene
δ-Cadinene	0.04	Sesquiterpene
Unknown	0.01	Oxygenated sesquiterpene
Germacrene B	0.27	Sesquiterpene
Spathulenol	0.01	Sesquiterpenic alcohol
Viridiflorol	0.01	Sesquiterpenic alcohol
Ledol	0.01	Sesquiterpenic alcohol
10-epi-γ-Eudesmol	0.01	Sesquiterpenic alcohol
Unknown	0.01	Sesquiterpenic alcohol
α-Cadinol	0.01	Sesquiterpenic alcohol
<b>Consolidated total</b>	<b>98.82%</b>	

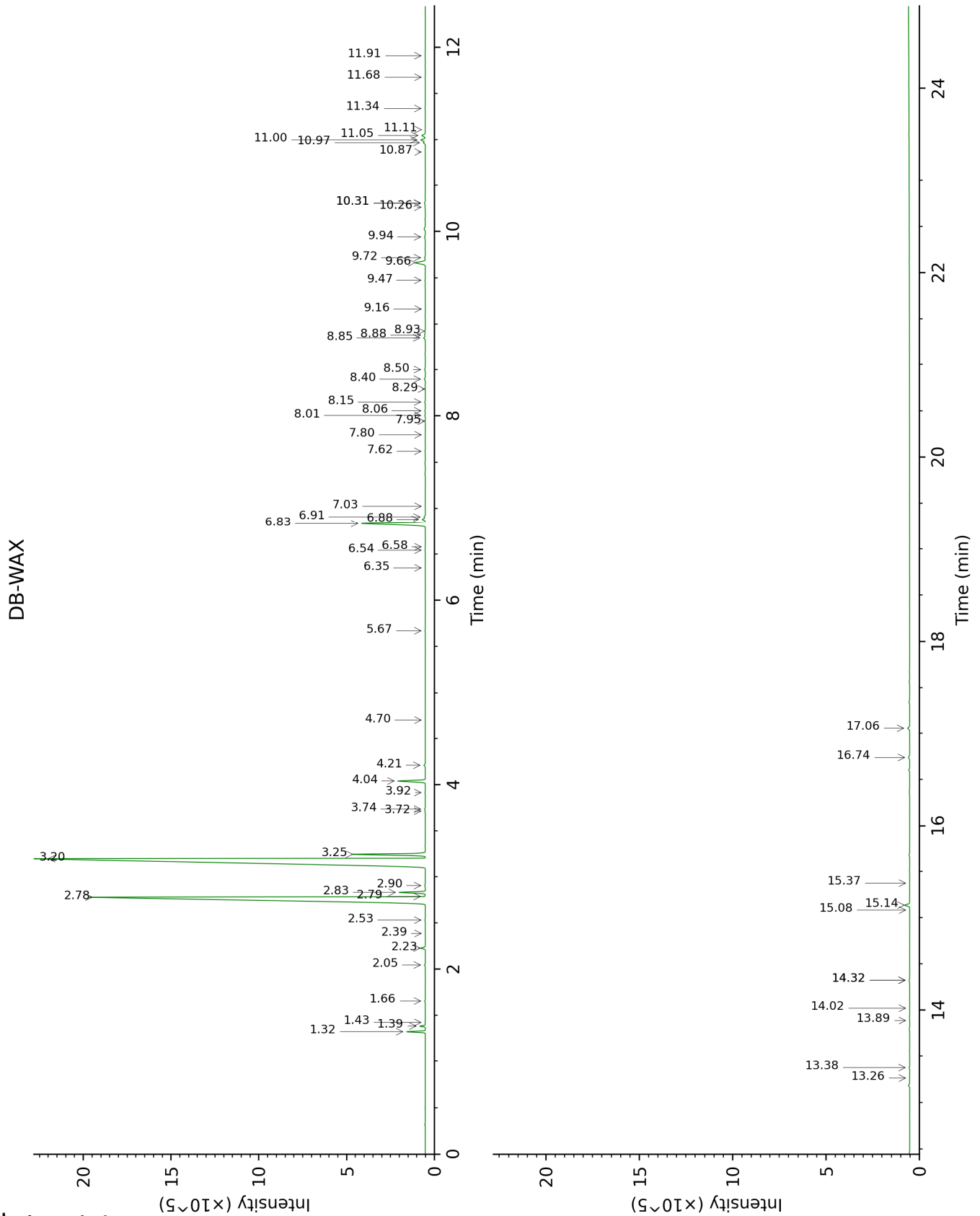
Note: no correction factor was applied

**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.

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FULL ANALYSIS DATA

Identification	Column DB-5			Column DB-WAX		
	R.T	R.I	%	R.T	R.I	%
Toluene	1.26	758	0.01	1.42	1002	0.01
$\alpha$ -Thujene	3.17	926	0.18	1.39	998	0.19
$\alpha$ -Pinene	3.25	931	0.68	1.32	991	0.67
3-Methylcyclohexanone	3.44*	944	0.04	4.70	1275	0.01
Camphene	3.44*	944	[0.04]	1.66	1026	0.03
$\beta$ -Pinene	3.86*	971	0.25	2.05	1066	0.04
Sabinene	3.86*	971	[0.25]	2.23	1084	0.21
Myrcene	4.20	993	1.06	2.83	1134	1.06
Pseudolimonene	4.39*	1006	34.18	2.79	1130	0.02
$\alpha$ -Phellandrene	4.39*	1006	[34.18]	2.78	1130	34.11
$\Delta^3$ -Carene	4.44	1009	0.03	2.53	1110	0.03
$\alpha$ -Terpinene	4.54	1015	0.03	2.90	1140	0.04
para-Cymene	4.67*	1023	1.31	4.04	1227	1.33
Carvomenthene	4.67*	1023	[1.31]	2.39	1099	0.01
Limonene	4.81*	1032	54.02	3.20	1164	50.82
$\beta$ -Phellandrene	4.81*	1032	[54.02]	3.25	1167	3.20
(Z)- $\beta$ -Ocimene	4.95	1041	0.02	3.72	1203	0.02
(E)- $\beta$ -Ocimene	5.10	1050	0.02	3.92	1218	0.02
$\gamma$ -Terpinene	5.22	1058	0.04	3.74	1205	0.04
Terpinolene	5.68	1087	0.07	4.21	1239	0.07
Linalool	5.93	1102	0.03	8.01	1519	0.03
1,3,8-para-Menthatriene	6.04	1109	0.02	5.67	1345	0.02
cis-para-Menth-2-en-1-ol	6.20	1119	0.04	8.06	1522	0.03
Limona ketone	6.33	1128	0.02	7.80	1502	0.01
cis-Limonene oxide	6.37	1130	0.01	6.35	1394	0.01
trans-Limonene oxide	6.42	1134	0.01	6.54	1409	0.01
trans-para-Menth-2-en-1-ol	6.49	1138	0.02	8.88	1586	0.06
Unknown [m/z 95, 43 (74), 109 (72), 82 (62), 110 (50)... 152 (14)]	6.62	1147	0.16	6.88	1434	0.16
Menthone	6.68	1150	0.02	6.58	1412	0.01
Menthofuran	6.85	1161	3.81	6.83	1430	3.76
Unknown [m/z 95, 110 (43), 81 (28), 41 (15)... 152 (8)]	6.96	1168	0.03	7.62	1489	0.02
Terpinen-4-ol	7.06	1175	0.04	8.50	1557	0.05
trans-Isocarveol	7.22	1184	0.02	10.87	1749	0.01
$\alpha$ -Terpineol	7.29	1189	0.05	9.72	1654	0.05
cis- $\alpha$ -Phellandrene epoxide (iPr vs Me)	7.45	1199	0.11	10.97	1757	0.11
trans-Piperitol	7.56	1206	0.02	10.31*	1702	0.06
Unknown [m/z 43, 111 (88), 126 (74), 125 (61)... 168? (2)]	7.74*	1218	0.05	11.11	1769	0.01



<i>trans</i> -Carveol	7.74*	1218	[0.05]	11.34	1788	0.02
<i>cis</i> -para-Mentha-1(7),8-dien-2-ol	7.87	1227	0.01	11.91	1838	0.03
<i>cis</i> -Carveol	7.92	1230	0.01	11.68	1818	0.01
Pulegone	7.98*	1235	0.14	8.85	1584	0.09
Thymol methyl ether	7.98*	1235	[0.14]	8.40	1549	0.05
Unknown [m/z 43, 97 (69), 107 (46), 41 (28), 55 (21), 109 (20)...]	8.21	1250	0.22	11.05	1764	0.23
Unknown [m/z 43, 97 (78), 41 (45), 55 (35), 69 (28), 107 (24), 83 (23)...]	8.38	1261	0.02	13.38	1972	0.03
Bornyl acetate	8.72	1284	0.04	8.15	1530	0.03
Unknown [m/z 93, 43 (60), 108 (58), 69 (36), 41 (35)... 150 (5), 184 (1)]	8.83	1291	0.03			
para-Menth-5-en-1,2-diol isomer II	9.05	1306	0.03	14.32*	2061	0.04
para-Menth-5-en-1,2-diol isomer III	9.18	1315	0.27	15.14	2140	0.28
Unknown [m/z 150, 71 (67), 107 (54), 43 (44), 109 (42)...]	9.47	1335	0.02			
Menthofuro lactone isomer I	9.50	1338	0.03			
$\alpha$ -Ylangene	9.95	1369	0.01	6.91	1436	0.07
$\alpha$ -Copaene	10.01	1374	0.01	7.02	1445	0.01
Unknown [m/z 71, 100 (92), 111 (79), 69 (46), 109 (45)...]	10.28	1393	0.11	17.06	2337	0.12
$\alpha$ -Cedrene	10.47	1406	0.03	7.94	1514	0.01
Unknown [m/z 43, 57 (37), 69 (30), 55 (29), 87 (23)... 168 (5)]	10.59	1415	0.11	16.74	2304	0.08
$\beta$ -Copaene	10.71	1424	0.04	8.29	1541	0.01
$\gamma$ -Elemene	10.82	1432	0.03	8.92	1590	0.03
$\alpha$ -Humulene	11.00	1445	0.02	9.16	1609	0.01
Unknown [m/z 109, 110 (33), 43 (30), 95 (23), 71 (20), 41 (19)...]	11.09	1452	0.02			
$\gamma$ -Murolene	11.39	1474	0.01	9.48	1634	0.03
Germacrene D	11.43	1477	0.72	9.66	1649	0.71
Bicyclogermacrene	11.63	1492	0.04	9.94	1672	0.05
$\gamma$ -Cadinene	11.85	1508	0.05	10.26	1698	0.03
$\delta$ -Cadinene	12.01	1521	0.04	10.31*	1702	[0.06]
Unknown [m/z 122, 105 (39), 107 (38), 91 (32), 81 (31), 161 (30), 119 (28)... 207? (20)]	12.14	1531	0.01			
Germacrene B	12.39	1551	0.27	11.00	1760	0.27

Spathulenol	12.65	1572	0.01	14.32*	2061	[0.04]
Viridiflorol	12.83	1585	0.01	13.89	2020	0.01
Ledol	12.97	1596	0.01	13.26	1961	0.02
10-epi- $\gamma$ -Eudesmol	13.17	1612	0.01	14.02	2032	0.01
Unknown cadinol analog II [m/z 95, 121 (73), 43 (57), 79 (43), 161 (43), 109 (40)... 204 (35), 222 (2)]	13.59	1647	0.01	15.08	2134	0.01
$\alpha$ -Cadinol	13.63	1650	0.01	15.37	2163	0.01
<b>Total identified</b>		<b>98.10%</b>			<b>97.99%</b>	
<b>Total reported</b>		<b>98.84%</b>			<b>98.66%</b>	

\*: Two or more compounds are coeluting on this column

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

Note: no correction factor was applied

R.T.: Retention time (minutes)

R.I.: Retention index