

Date : May 04, 2021

CERTIFICATE OF ANALYSIS – GC PROFILING

SAMPLE IDENTIFICATION

**Internal code** : 21D20-ORA03

**Customer identification** : Lavender - France - 3 years - 050050A

**Type** : Essential oil

**Source** : *Lavandula angustifolia x latifolia*

**Customer** : Organic Aromas Inc.

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** : Benoit Roger, Ph. D.

**Analysis date** : May 03, 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 liquid

**Refractive index:**  $1.4614 \pm 0.0003$  (20 °C; method PC-MAT-016)

#### CONCLUSION

No adulterant, contaminant or diluent has been detected using this method. Please take note that the term "lavender" should be used only to describe true lavender (*Lavandula angustifolia, stricto sensu*), whereas "lavandin" should be used to label *Lavandula angustifolia x latifolia* hybrids such as this batch.

## ANALYSIS SUMMARY – CONSOLIDATED CONTENTS

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

Identification	%	Class
Isovaleral	0.02	Aliphatic aldehyde
2-Methylbutyral	0.01	Aliphatic aldehyde
Hexanal	tr	Aliphatic aldehyde
Methyl hexyl ether	0.02	Aliphatic ether
(3Z)-Hexenol	0.04	Aliphatic alcohol
Hexanol	0.19	Aliphatic alcohol
Tricyclene	0.01	Monoterpene
$\alpha$ -Thujene	0.06	Monoterpene
$\alpha$ -Pinene	0.25	Monoterpene
Camphene	0.18	Monoterpene
Thuja-2,4(10)-diene	0.01	Monoterpene
Butyl isobutyrate	tr	Aliphatic ester
$\beta$ -Pinene	0.21	Monoterpene
Sabinene	0.06	Monoterpene
Octen-3-ol	0.18	Aliphatic alcohol
Octan-3-one	0.06	Aliphatic ketone
Myrcene	0.52	Monoterpene
Octan-3-ol	0.04	Aliphatic alcohol
$\alpha$ -Phellandrene	0.02	Monoterpene
<i>cis</i> -Dehydroxylinalool oxide	0.02	Monoterpenic ether
$\Delta^3$ -Carene	0.05	Monoterpene
$\alpha$ -Terpinene	0.04	Monoterpene
Hexyl acetate	0.07	Aliphatic ester
ortho-Cymene	0.01	Monoterpene
para-Cymene	0.14	Monoterpene
1,8-Cineole	3.69	Monoterpenic ether
Limonene	0.58	Monoterpene
Lavender lactone	0.02	Aliphatic lactone
(Z)- $\beta$ -Ocimene	0.74	Monoterpene
(E)- $\beta$ -Ocimene	0.31	Monoterpene
$\gamma$ -Terpinene	0.10	Monoterpene
<i>cis</i> -Sabinene hydrate	0.06	Monoterpenic alcohol
<i>cis</i> -Linalool oxide (fur.)	0.13	Monoterpenic alcohol
Octanol	0.03	Aliphatic alcohol
$\alpha$ -Pinene oxide analog	0.06	Monoterpenic ether
Terpinolene	0.19	Monoterpene
<i>trans</i> -Linalool oxide (fur.)	0.11	Monoterpenic alcohol
<i>trans</i> -Sabinene hydrate	0.01	Monoterpenic alcohol
Linalool	33.80	Monoterpenic alcohol
(Z)-6-Methyl-3,5-heptadien-2-one	0.10	Aliphatic ketone
Octen-3-yl acetate	0.19	Aliphatic ester
$\alpha$ -Campholenal	0.02	Monoterpenic aldehyde
Octan-3-yl acetate	0.03	Aliphatic ester
Camphor	7.10	Monoterpenic ketone
Camphene hydrate	0.04	Monoterpenic alcohol

Hexyl isobutyrate	0.01	Aliphatic ester
Nerol oxide	0.17	Aliphatic ether
Borneol	2.70	Monoterpenic alcohol
$\delta$ -Terpineol	0.09	Monoterpenic alcohol
Lavandulol	0.71	Monoterpenic alcohol
Terpinen-4-ol	3.70	Monoterpenic alcohol
(3E,5Z)-Undeca-1,3,5-triene	0.01	Alkene
Cryptone	0.03	Normonoterpenic ketone
$\alpha$ -Terpineol	1.08	Monoterpenic alcohol
Myrtenal	0.03	Monoterpenic aldehyde
Hexyl butyrate	0.32	Aliphatic ester
Verbenone	0.04	Monoterpenic ketone
Octyl acetate	0.03	Aliphatic ester
Bornyl formate	0.04	Monoterpenic ester
Nerol	0.17	Monoterpenic alcohol
Hexyl 2-methylbutyrate	0.02	Aliphatic ester
Neral	0.07	Monoterpenic aldehyde
Hexyl isovalerate	0.18	Aliphatic ester
Geraniol	0.48	Monoterpenic alcohol
Linalyl acetate	29.58	Monoterpenic ester
Geranial	0.01	Monoterpenic aldehyde
Bornyl acetate	0.04	Monoterpenic ester
Lavandulyl acetate	1.90	Monoterpenic ester
Hexyl tiglate	0.23	Aliphatic ester
Hodiendiol derivative	0.02	Oxygenated monoterpene
Unknown	0.01	Oxygenated monoterpene
Unknown	0.04	Oxygenated monoterpene
Neryl acetate	0.29	Monoterpenic ester
$\alpha$ -Copaene	0.02	Sesquiterpene
Daucene	0.10	Sesquiterpene
$\beta$ -Bourbonene	0.07	Sesquiterpene
Geranyl acetate	0.57	Monoterpenic ester
7-epi-Sesquithujene	0.09	Sesquiterpene
Hexyl hexanoate	tr	Aliphatic ester
$\alpha$ -Funebrene	0.02	Sesquiterpene
Isocaryophyllene	0.03	Sesquiterpene
Sesquithujene	0.11	Sesquiterpene
$\beta$ -Caryophyllene	1.50	Sesquiterpene
<i>cis</i> - $\alpha$ -Bergamotene	0.06	Sesquiterpene
$\alpha$ -Santalene	0.23	Sesquiterpene
Lavandulyl isobutyrate	0.07	Monoterpenic ester
Coumarin	0.15	Coumarin
<i>trans</i> - $\alpha$ -Bergamotene	0.16	Sesquiterpene
<i>cis</i> - $\beta$ -Bergamotene?	0.10	Sesquiterpene
$\alpha$ -Humulene	0.06	Sesquiterpene
Lavandulyl butyrate?	0.11	Monoterpenic ester
( <i>E</i> )- $\beta$ -Farnesene	1.37	Sesquiterpene
Dauca-5,8-diene?	0.07	Sesquiterpene
<i>trans</i> -Cadina-1(6),4-diene	0.10	Sesquiterpene
Germacrene D	0.67	Sesquiterpene
<i>trans</i> - $\beta$ -Bergamotene	0.06	Sesquiterpene
Isodaucene	0.10	Sesquiterpene

$\alpha$ -Muurolene	0.05	Sesquiterpene
$\gamma$ -Cadinene	0.24	Sesquiterpene
$\beta$ -Bisabolene	0.18	Sesquiterpene
Lavandulyl isovalerate	0.31	Monoterpenic ester
$\delta$ -Cadinene	0.03	Sesquiterpene
$\beta$ -Sesquiphellandrene	0.18	Sesquiterpene
Isocaryophyllene epoxide B	0.04	Sesquiterpenic ether
Caryophyllene oxide	0.11	Sesquiterpenic ether
Caryophyllene oxide isomer	0.03	Sesquiterpenic ether
$\tau$ -Cadinol	0.16	Sesquiterpenic alcohol
$\alpha$ -Bisabolol	0.43	Sesquiterpenic alcohol
<b>Consolidated total</b>	<b>99.09%</b>	

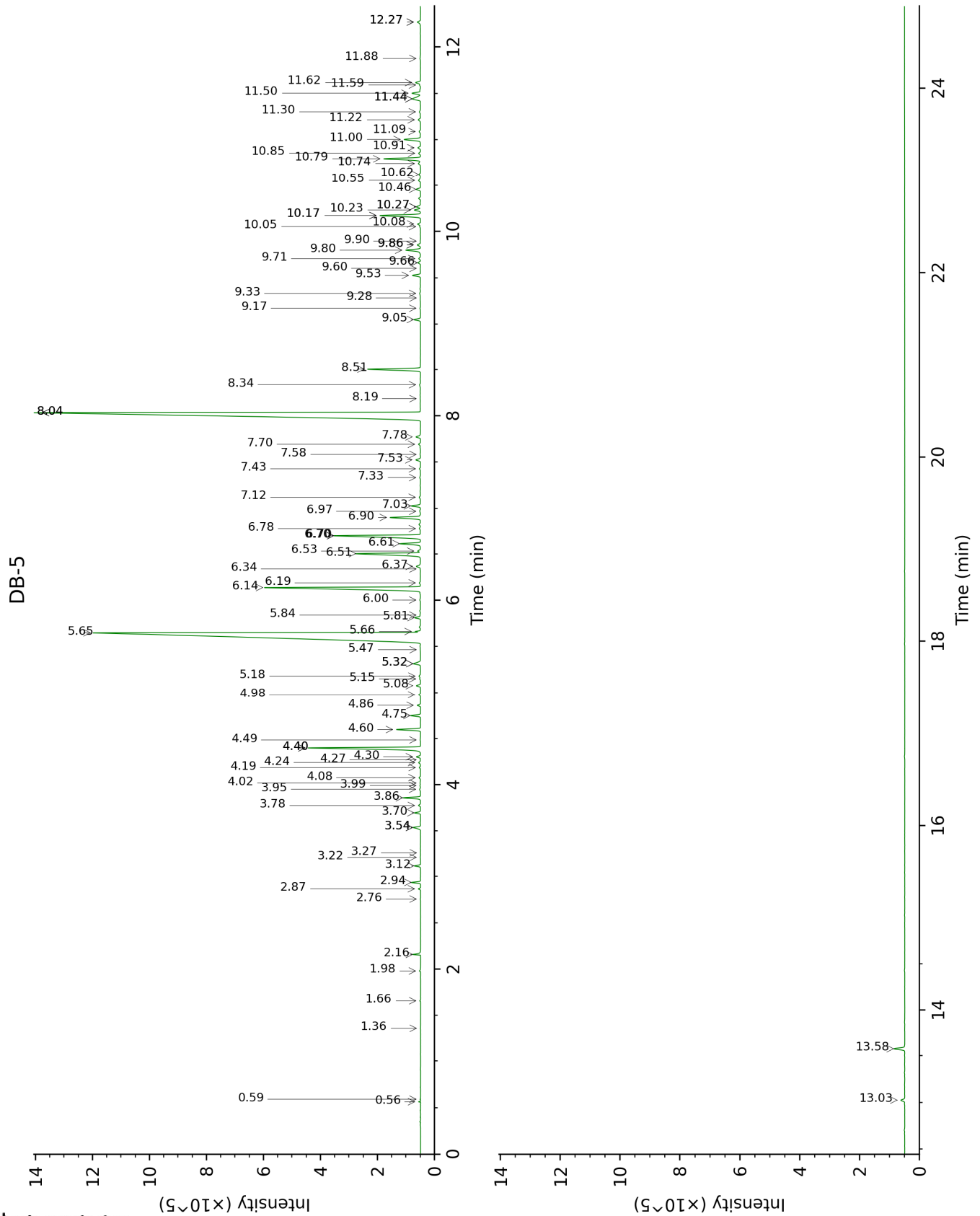
tr: The compound has been detected below 0.005% of total signal.

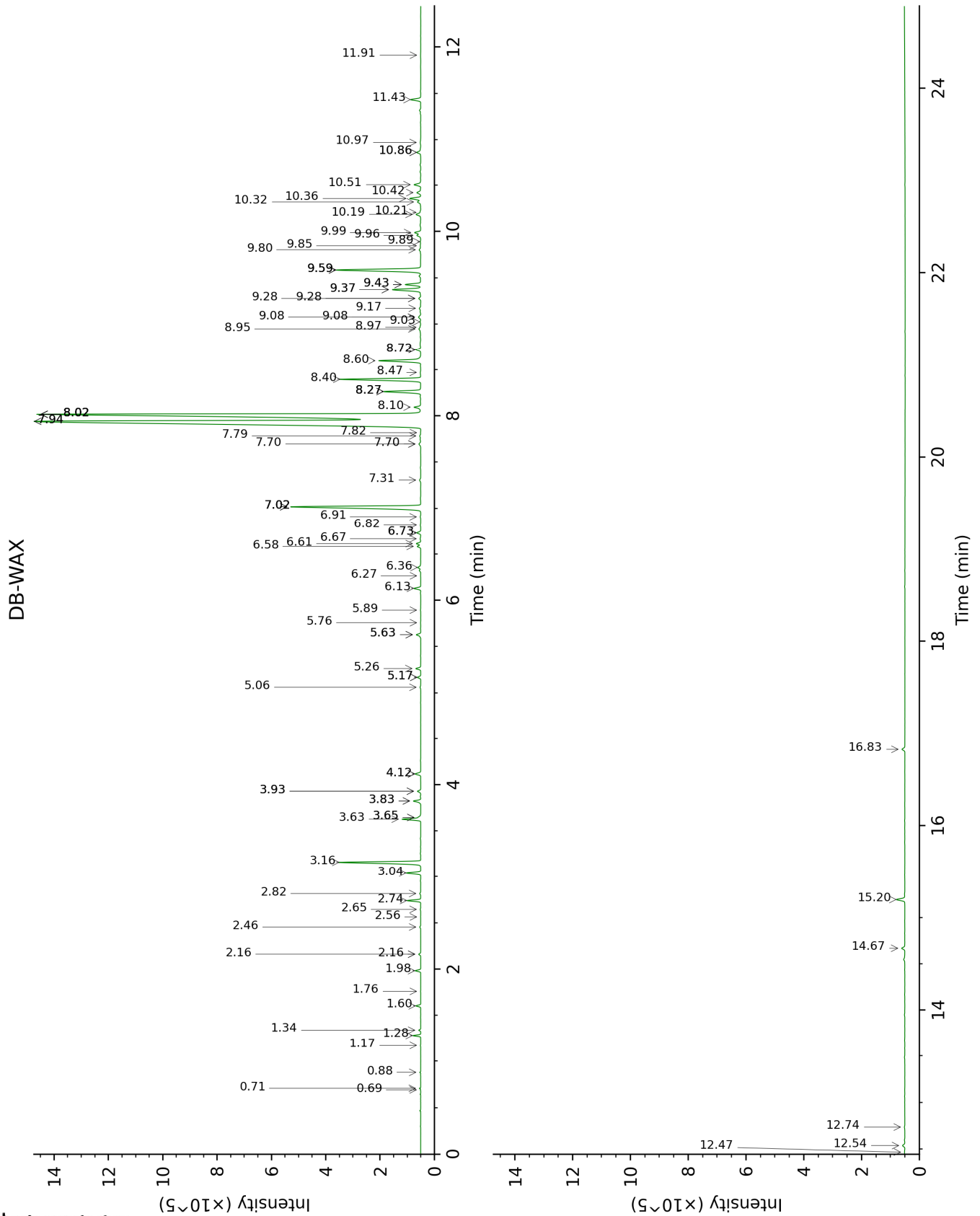
Note: no correction factor was applied

**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	%
Isovaleral	0.56	639	0.02	0.71	887	0.02
2-Methylbutyral	0.59	650	0.01	0.69	881	0.01
Hexanal	1.36	801	tr	1.76	1043	0.01
Methyl hexyl ether	1.66	828	0.02	0.88	923	0.02
(3Z)-Hexenol	1.98	856	0.04	5.63*	1349	0.22
Hexanol	2.16	872	0.19	5.26	1322	0.21
Tricyclene	2.76	920	0.01	1.17	973	0.01
α-Thujene	2.87	927	0.06	1.34	1001	0.06
α-Pinene	2.94	932	0.25	1.28	992	0.25
Camphene	3.12	944	0.18	1.60	1027	0.17
Thuja-2,4(10)-diene	3.22	950	0.01	2.16*	1084	0.07
Butyl isobutyrate	3.26	954	tr	2.56	1120	0.01
β-Pinene	3.54*	972	0.27	1.98	1066	0.21
Sabinene	3.54*	972	[0.27]	2.16*	1084	[0.07]
Octen-3-ol	3.70	983	0.18	6.61	1421	0.18
Octan-3-one	3.78	988	0.06	3.83*	1219	0.34
Myrcene	3.86	994	0.52	2.74	1134	0.51
Octan-3-ol	3.95	1000	0.04	5.90	1368	0.02
α-Phellandrene	3.99	1003	0.02	2.65	1126	0.02
<i>cis</i> -Dehydroxylinalool oxide	4.02	1005	0.02	3.65*†	1206	[0.85]
Δ3-Carene	4.08	1008	0.05	2.46	1111	0.04
α-Terpinene	4.19	1015	0.04	2.82	1140	0.04
Hexyl acetate	4.24	1019	0.07	4.12*	1241	0.26
ortho-Cymene	4.27	1021	0.01	3.93*	1227	0.15
para-Cymene	4.30	1023	0.14	3.93*	1227	[0.15]
1,8-Cineole	4.40*	1029	4.27	3.16	1167	3.69
Limonene	4.40*	1029	[4.27]	3.04	1157	0.58
Lavender lactone	4.48	1034	0.02	9.02	1606	0.03
(Z)-β-Ocimene	4.60	1041	0.74	3.63†	1204	0.85
(E)-β-Ocimene	4.75	1051	0.31	3.83*	1219	[0.34]
γ-Terpinene	4.86	1058	0.10	3.65*†	1206	[0.85]
<i>cis</i> -Sabinene hydrate	4.98	1065	0.06	6.73*	1430	0.17
<i>cis</i> -Linalool oxide (fur.)	5.08	1072	0.13	6.36	1402	0.15
Octanol	5.15	1076	0.03	8.02*†	1527	[63.58]
α-Pinene oxide analog	5.18	1078	0.06	5.17*	1316	0.14
Terpinolene	5.32*	1087	0.32	4.12*	1241	[0.26]
<i>trans</i> -Linalool oxide (fur.)	5.32*	1087	[0.32]	6.73*	1430	[0.17]
<i>trans</i> -Sabinene hydrate	5.47	1096	0.01	7.78	1509	0.06
Linalool	5.65	1108	33.80	7.94*†	1521	63.58
(Z)-6-Methyl-3,5-heptadien-2-one	5.66	1109	0.10	8.02*†	1527	[63.58]

Octen-3-yl acetate	5.81	1119	0.19	5.63*	1349	[0.22]
α-Campholenal	5.84	1120	0.02	6.82	1436	0.02
Octan-3-yl acetate	6.00	1131	0.03	5.06	1308	0.04
Camphor	6.14	1140	7.10	7.02*	1451	7.16
Camphene hydrate	6.19	1143	0.04	8.26*	1546	1.70
Hexyl isobutyrate	6.34	1152	0.01	5.17*	1316	[0.14]
Nerol oxide	6.37	1154	0.17	6.67	1425	0.03
Borneol	6.51	1163	2.70	9.59*	1652	4.38
δ-Terpineol	6.53	1165	0.09	9.28*	1627	0.09
Lavandulol	6.61	1170	0.71	9.43*	1639	0.70
Terpinen-4-ol	6.70*	1176	3.70	8.40	1557	3.70
(3E,5Z)-Undeca- 1,3,5-triene	6.70*	1176	[3.70]	5.76	1358	0.01
Cryptone	6.78	1180	0.03	8.97	1601	0.03
α-Terpineol	6.90	1189	1.08	9.59*	1652	[4.38]
Myrtenal	6.97	1193	0.03	8.47	1563	0.03
Hexyl butyrate	7.03	1197	0.32	6.13	1385	0.29
Verbenone	7.12	1203	0.04	9.43*	1639	[0.70]
Octyl acetate	7.34	1217	0.03	6.91	1443	0.02
Bornyl formate	7.43	1223	0.04	7.82	1512	0.01
Nerol	7.53	1230	0.17	10.86*	1759	0.23
Hexyl 2- methylbutyrate	7.58	1234	0.02	6.27	1395	0.01
Neral	7.70	1241	0.07	9.28*	1627	[0.09]
Hexyl isovalerate	7.78	1247	0.18	6.58	1419	0.15
Geraniol	8.04*	1264	30.05	11.43	1808	0.48
Linalyl acetate	8.04*	1264	[30.05]	8.02*†	1527	[63.58]
Geranial	8.19	1274	0.01	9.89	1677	0.02
Bornyl acetate	8.34	1284	0.04	8.10	1533	0.31
Lavandulyl acetate	8.51	1296	1.90	8.60	1573	2.00
Hexyl tiglate	9.05	1334	0.23	8.72*	1582	0.23
Hodiendiol derivative	9.17	1342	0.02	12.74	1925	0.03
Unknown [m/z 43, 79 (47), 71 (31), 94 (27), 81 (23), 41 (22)... 197 (0)]	9.28	1350	0.01	10.86*	1759	[0.23]
Unknown [m/z 43, 79 (46), 71 (30), 94 (25), 41 (23), 81 (21)... 197 (0)]	9.33	1354	0.04	10.97	1768	0.05
Neryl acetate	9.53	1368	0.29	9.99	1685	0.29
α-Copaene	9.60	1373	0.02	7.02*	1451	[7.16]
Daucene	9.66	1377	0.10	7.02*	1451	[7.16]
β-Bourbonene	9.71	1380	0.07	7.31	1473	0.06
Geranyl acetate	9.80	1387	0.57	10.36	1716	0.51
7-epi- Sesquithujene	9.86*	1391	0.13	7.70*	1502	0.11
Hexyl hexanoate	9.86*	1391	[0.13]	8.72*	1582	[0.23]
α-Funebrene	9.90	1394	0.02	7.70*	1502	[0.11]
Isocaryophyllene	10.05	1405	0.03	8.02*†	1527	[63.58]
Sesquithujene	10.08	1407	0.11	7.94*†	1521	[63.58]

β-Caryophyllene	10.17*	1414	1.57	8.26*	1546	[1.70]
cis-α-Bergamotene	10.17*	1414	[1.57]	8.02*†	1527	[63.58]
α-Santalene	10.23	1418	0.23	8.02*†	1527	[63.58]
Lavandulyl isobutyrate	10.27*	1421	0.16	9.17	1618	0.07
Coumarin	10.27*	1421	[0.16]	16.83	2333	0.15
trans-α-Bergamotene	10.46	1435	0.16	8.26*	1546	[1.70]
cis-β-Bergamotene?	10.56	1442	0.10			
α-Humulene	10.62	1447	0.06	9.08*	1610	0.13
Lavandulyl butyrate?	10.74	1456	0.11	10.32	1712	0.18
(E)-β-Farnesene	10.79	1460	1.37	9.37*	1635	1.38
Dauca-5,8-diene?	10.85	1464	0.07	8.95	1600	0.10
trans-Cadina-1(6),4-diene	10.91	1469	0.10	9.08*	1610	[0.13]
Germacrene D	11.00	1476	0.67	9.59*	1652	[4.38]
trans-β-Bergamotene	11.09	1482	0.06	9.37*	1635	[1.38]
Isodaucene	11.22	1492	0.10	9.80	1670	0.09
α-Murolene	11.30	1498	0.05	9.85	1673	0.03
γ-Cadinene	11.44*	1509	0.50	10.19	1701	0.24
β-Bisabolene	11.44*	1509	[0.50]	9.96	1683	0.18
Lavandulyl isovalerate	11.50	1513	0.31	10.51	1728	0.33
δ-Cadinene	11.59	1520	0.03	10.21	1703	0.03
β-Sesquiphellandrene	11.62	1522	0.18	10.42	1721	0.22
Isocaryophyllene epoxide B	11.88	1543	0.04	11.91	1851	0.01
Caryophyllene oxide	12.27*	1574	0.14	12.54	1907	0.11
Caryophyllene oxide isomer	12.27*	1574	[0.14]	12.47	1900	0.03
τ-Cadinol	13.03	1635	0.16	14.67	2110	0.16
α-Bisabolol	13.58	1680	0.43	15.20	2163	0.41
<b>Total identified</b>		<b>99.10%</b>			<b>98.56%</b>	
<b>Total reported</b>		<b>99.15%</b>			<b>98.61%</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