

**Date :** February 22, 2021

**CERTIFICATE OF ANALYSIS – GC PROFILING**

**SAMPLE IDENTIFICATION**

**Internal code :** 21B15-PTH18

**Customer identification :** Lavender Fine ORGANIC - France - LM010697R

**Type :** Essential oil

**Source :** *Lavandula angustifolia*

**Customer :** Plant Therapy

**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

**Analysis date :** February 22, 2021

Checked and approved by :

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

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### PHYSICOCHEMICAL DATA

**Physical aspect:** Faintly yellow liquid

**Refractive index:** 1.4613 ± 0.0003 (20 °C; method PC-MAT-016)

### ISO 3515:2004 - OIL OF SPONTANEOUS LAVENDER - FRANCE

Compound	Min. %	Max. %	Observed %	Complies?
Limonene		0.5	0.3	Yes
1,8-Cineole		1.0		
β-Phellandrene	tr	0.50	0.81*	Yes
(Z)-β-Ocimene	4	10	3	No
(E)-β-Ocimene	1.5	6.0	3.0	Yes
Octan-3-one	tr	2.0	1.0	Yes
Camphor	tr	0.50	0.39	Yes
Linalool	25	38	29	Yes
Linalyl acetate	25	45	36	Yes
Lavandulol	0.3		0.9	Yes
Terpinen-4-ol	2	6	3	Yes
Lavandulyl acetate	2.0		2.8	Yes
α-Terpineol		1.0	0.8	Yes
<b>Refractive index</b>	1.4580	1.4640	1.4613	Yes

\*Coeluted on both columns considered

### 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
Ethanol	tr	Aliphatic alcohol
3-Buten-2-one	0.01	Aliphatic ketone
2-Methyl-3-buten-2-ol	0.02	Aliphatic alcohol
Isovaleral	0.01	Aliphatic aldehyde
2-Methylbutyral	tr	Aliphatic aldehyde
Isoamyl alcohol	0.01	Aliphatic alcohol
2-Methylbutanol	0.01	Aliphatic alcohol
Toluene	0.01	Simple phenolic
Prenal	0.01	Aliphatic aldehyde
Hexanal	0.01	Aliphatic aldehyde
Butyl acetate	0.01	Aliphatic ester
Methyl hexyl ether	0.06	Aliphatic ether
(3Z)-Hexenol	0.08	Aliphatic alcohol
Hexanol	0.14	Aliphatic alcohol
Hashishene	0.01	Monoterpene
Tricyclene	0.02	Monoterpene
$\alpha$ -Thujene	0.06	Monoterpene
$\alpha$ -Pinene	0.14	Monoterpene
Camphene	0.15	Monoterpene
$\alpha$ -Fenchene	0.01	Monoterpene
5,5-Dimethyl-2(5H)-furanone	0.03	Aliphatic lactone
Butyl isobutyrate	0.01	Aliphatic ester
$\beta$ -Pinene	0.09	Monoterpene
Sabinene	0.03	Monoterpene
Octen-3-ol	0.32	Aliphatic alcohol
Octan-3-one	0.97	Aliphatic ketone
6-Methyl-5-hepten-2-one	0.01	Aliphatic ketone
Dehydro-1,8-cineole	0.01	Monoterpenic ether
Myrcene	0.44	Monoterpene
<i>trans</i> -Dehydroxylinalool oxide	0.03	Monoterpenic ether
Butyl butyrate	0.09	Aliphatic ester
Octan-3-ol	0.20	Aliphatic alcohol
$\alpha$ -Phellandrene	0.02	Monoterpene
<i>cis</i> -Dehydroxylinalool oxide	0.06	Monoterpenic ether
$\Delta^3$ -Carene	0.10	Monoterpene
(3Z)-Hexenyl acetate	0.02	Aliphatic ester
$\alpha$ -Terpinene	0.03	Monoterpene
Hexyl acetate	0.32	Aliphatic ester
ortho-Cymene	0.06	Monoterpene
para-Cymene	0.18	Monoterpene
Limonene	0.27	Monoterpene
$\beta$ -Phellandrene	0.81*	Monoterpene
1,8-Cineole	[0.81]*	Monoterpenic ether
Lavender lactone	0.03	Aliphatic lactone
Benzyl alcohol	0.02	Simple phenolic

(Z)-β-Ocimene	2.82	Monoterpene
(E)-β-Ocimene	2.97	Monoterpene
γ-Terpinene	0.10	Monoterpene
cis-Sabinene hydrate	0.05	Monoterpenic alcohol
cis-Linalool oxide (fur.)	0.23	Monoterpenic alcohol
Octanol	0.03	Aliphatic alcohol
α-Pinene oxide analog	0.02	Monoterpenic ether
Terpinolene	0.07	Monoterpene
trans-Linalool oxide (fur.)	0.17	Monoterpenic alcohol
Rosefuran	0.03	Monoterpenic ether
Linalool	28.89	Monoterpenic alcohol
(Z)-6-Methyl-3,5-heptadien-2-one	0.20	Aliphatic ketone
Octen-3-yl acetate	0.94	Aliphatic ester
Unknown	tr	Unknown
Octan-3-yl acetate	0.09	Aliphatic ester
allo-Ocimene	0.07	Monoterpene
(Z)-Myroxide	0.04	Monoterpenic ether
Camphor	0.39	Monoterpenic ketone
(E)-Myroxide	0.02	Monoterpenic ether
trans-Verbenol	0.03	Monoterpenic alcohol
Hexyl isobutyrate	0.06	Aliphatic ester
Borneol	1.04	Monoterpenic alcohol
cis-Linalool oxide (pyr.)	0.04	Monoterpenic alcohol
Lavandulol	0.90	Monoterpenic alcohol
Terpinen-4-ol	2.59	Monoterpenic alcohol
meta-Cymen-8-ol	0.13	Monoterpenic alcohol
Cryptone	0.14	Normonoterpenic ketone
para-Cymen-8-ol	0.10	Monoterpenic alcohol
α-Terpineol	0.85	Monoterpenic alcohol
Myrtenal	0.08	Monoterpenic aldehyde
Hodiendiol	0.04	Monoterpenic alcohol
Hexyl butyrate	0.36	Aliphatic ester
Unknown	0.05	Unknown
(3E,5E)-2,6-Dimethylocta-3,5,7-trien-2-ol	0.06	Monoterpenic alcohol
trans-Carveol	0.03	Monoterpenic alcohol
Bornyl formate	0.05	Monoterpenic ester
Nerol	0.17	Monoterpenic alcohol
Hexyl 2-methylbutyrate	0.05	Aliphatic ester
Cuminal	0.02	Monoterpenic aldehyde
Carvone	0.04	Monoterpenic ketone
Neral	0.02	Monoterpenic aldehyde
Hexyl isovalerate	0.02	Aliphatic ester
Linalyl acetate	35.53	Monoterpenic ester
Geraniol	0.44	Monoterpenic alcohol
Geranial	0.04	Monoterpenic aldehyde
2,6-Dimethyl-1,7-octadiene-3,6-diol	0.04	Monoterpenic alcohol
Bornyl acetate	0.13	Monoterpenic ester
Cuminol	0.02	Monoterpenic alcohol
Lavandulyl acetate	2.84	Monoterpenic ester
Hexyl tiglate	0.06	Aliphatic ester
Hodiendiol derivative	0.04	Oxygenated monoterpene
Unknown	0.03	Oxygenated monoterpene

Unknown	0.03	Oxygenated monoterpene
Hodiendiol derivative III	0.01	Oxygenated monoterpene
Neryl acetate	0.30	Monoterpenic ester
$\alpha$ -Copaene	0.02	Sesquiterpene
7-Cubebene epimer?	0.02	Aliphatic alcohol
$\beta$ -Bourbonene	0.06	Sesquiterpene
Geranyl acetate	0.53	Monoterpenic ester
Hexyl hexanoate	0.10	Aliphatic ester
7-epi-Sesquithujene	0.07	Sesquiterpene
Isocaryophyllene	0.04	Sesquiterpene
Sesquithujene	0.08	Sesquiterpene
$\beta$ -Caryophyllene	3.82	Sesquiterpene
<i>cis</i> - $\alpha$ -Bergamotene	0.07	Sesquiterpene
$\alpha$ -Santalene	0.57	Sesquiterpene
Lavandulyl isobutyrate	0.10	Monoterpenic ester
<i>trans</i> - $\alpha$ -Bergamotene	0.15	Sesquiterpene
<i>cis</i> - $\beta$ -Bergamotene?	0.06	Sesquiterpene
Sesquisabinene A	0.04	Sesquiterpene
$\alpha$ -Humulene	0.23	Sesquiterpene
Lavandulyl butyrate?	0.17	Monoterpenic ester
( <i>E</i> )- $\beta$ -Farnesene	1.62	Sesquiterpene
$\beta$ -Santalene	0.02	Sesquiterpene
Germacrene D	0.39	Sesquiterpene
<i>trans</i> - $\beta$ -Bergamotene	0.07	Sesquiterpene
$\beta$ -Bisabolene	0.04	Sesquiterpene
Lavandulyl isovalerate	0.05	Monoterpenic ester
$\gamma$ -Cadinene	0.14	Sesquiterpene
$\beta$ -Sesquiphellandrene	0.04	Sesquiterpene
Isocaryophyllene epoxide B	0.04	Sesquiterpenic ether
( <i>E</i> )-Nerolidol	0.01	Sesquiterpenic alcohol
Caryophyllene oxide isomer	0.07	Sesquiterpenic ether
Caryophyllene oxide	0.41	Sesquiterpenic ether
Humulene epoxide I	0.11	Sesquiterpenic ether
Humulene epoxide II	0.02	Sesquiterpenic ether
$\tau$ -Cadinol	0.07	Sesquiterpenic alcohol
(3 <i>Z</i> )-Caryophylla-3,8(13)-dien-5 $\beta$ -ol	0.02	Sesquiterpenic alcohol
<i>cis</i> -14-nor-Muurool-5-en-4-one?	0.02	Norsesquiterpenic ketone
$\alpha$ -Bisabolol	0.03	Sesquiterpenic alcohol
Herniarin	0.01	Coumarin
9-(15,16-Dihydro-15-methylenegeranyl)- $\alpha$ -terpinene	0.04	Homoditerpene
<b>Consolidated total</b>	<b>97.75%</b>	

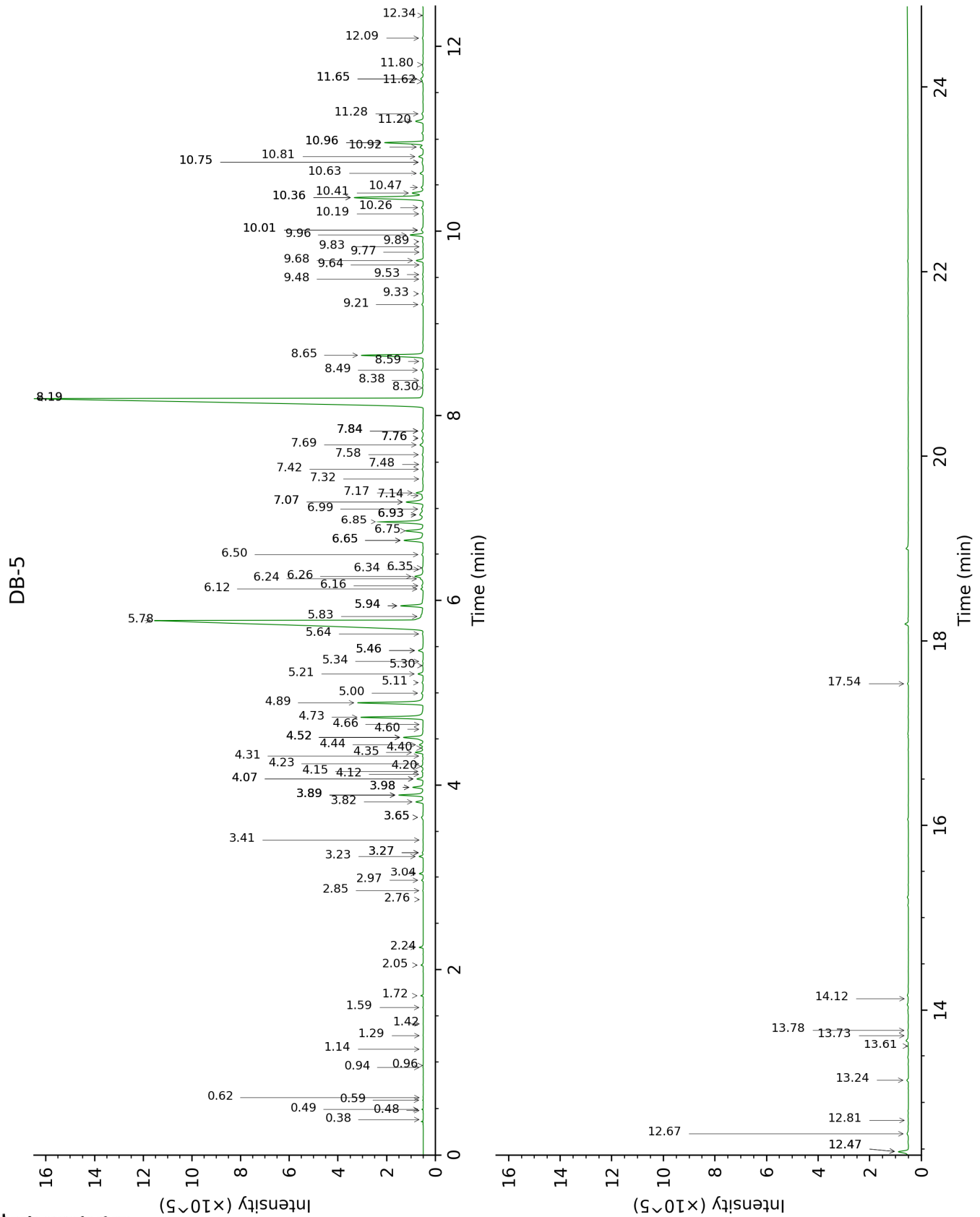
\*: Individual compounds concentration could not be found due to overlapping coelutions on columns considered  
[xx]: Duplicate percentage due to coelutions, not taken into account in the consolidated total  
tr: The compound has been detected below 0.005% of total signal.

Note: no correction factor was applied

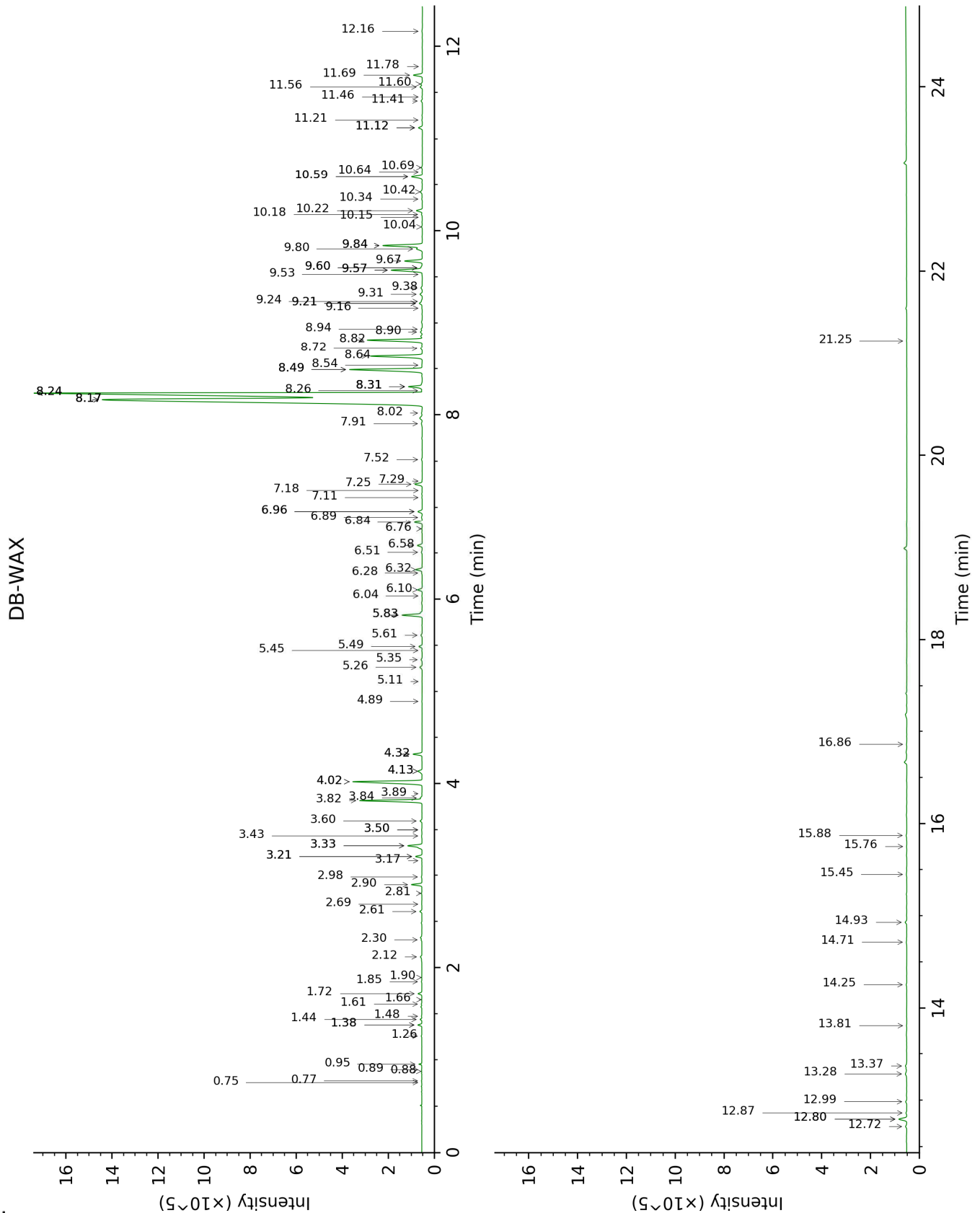
**About "consolidated" data:** The table above presents the breakdown of the sample volatile constituents after applying an algorithm to collapse data acquired from the multi-columns system of PhytoChemia into a single set of consolidated contents. In case of discrepancies between columns, the algorithm 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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FULL ANALYSIS DATA

Identification	Column DB-5			Column DB-WAX		
	R.T	R.I	%	R.T	R.I	%
Ethanol	0.38	524	tr	0.88	907	0.01
3-Buten-2-one	0.48	579	0.01	0.89	910	tr
2-Methyl-3-buten-2-ol	0.49	587	0.02	1.61	1015	0.02
Isovaleral	0.59	639	0.01	0.77	887	0.01
2-Methylbutyral	0.62	651	tr	0.75	880	tr
Isoamyl alcohol	0.94	737	0.01	3.50*	1181	0.02
2-Methylbutanol	0.96	740	0.01	3.50*	1181	[0.02]
Toluene	1.14	764	0.01	1.48	1002	0.02
Prenal	1.29	785	0.01	3.21*	1158	0.28
Hexanal	1.42	803	0.01	1.90	1044	0.01
Butyl acetate	1.59	819	0.01	1.85	1040	0.02
Methyl hexyl ether	1.72	829	0.06	0.95	920	0.06
(3Z)-Hexenol	2.05	856	0.08	5.83*†	1350	1.02
Hexanol	2.24	872	0.14	5.49	1326	0.15
Hashishene	2.76	912	0.01	1.38*	992	0.15
Tricyclene	2.85	918	0.02	1.26	972	0.02
α-Thujene	2.97	926	0.06	1.44	998	0.06
α-Pinene	3.04	930	0.14	1.38*	992	[0.15]
Camphene	3.23	943	0.15	1.72	1026	0.17
α-Fenchene	3.27*	946	0.04	1.66	1020	0.01
5,5-Dimethyl-2(5H)-furanone	3.27*	946	[0.04]	8.54	1552	0.03
Butyl isobutyrate	3.41	954	0.01	2.69	1117	0.01
β-Pinene	3.65*	971	0.10	2.12	1067	0.09
Sabinene	3.65*	971	[0.10]	2.30	1085	0.03
Octen-3-ol	3.82	982	0.32	6.84	1423	0.34
Octan-3-one	3.89*	986	0.99	4.02*	1220	3.98
6-Methyl-5-hepten-2-one	3.89*	986	[0.99]	5.11	1298	0.01
Dehydro-1,8-cineole	3.89*	986	[0.99]	3.17	1155	0.01
Myrcene	3.98*	992	0.45	2.90	1134	0.44
<i>trans</i> -Dehydroxylinalool oxide	3.98*	992	[0.45]	3.43	1176	0.03
Butyl butyrate	4.07*	998	0.27	3.60	1188	0.09
Octan-3-ol	4.07*	998	[0.27]	6.10	1370	0.20
α-Phellandrene	4.12	1001	0.02	2.80	1126	0.02
<i>cis</i> -Dehydroxylinalool oxide	4.15	1003	0.06	3.89	1210	0.01
Δ3-Carene	4.20	1007	0.10	2.61	1111	0.09
(3Z)-Hexenyl acetate	4.23	1008	0.02	4.89	1282	0.01
α-Terpinene	4.31	1014	0.03	2.98	1140	0.03
Hexyl acetate	4.35	1016	0.32	4.32*	1241	0.39
ortho-Cymene	4.40	1019	0.06	4.13*	1228	0.23

para-Cymene	4.44	1021	0.18	4.13*	1228	[0.23]
Limonene	4.52*	1026	1.08	3.21*	1158	[0.28]
β-Phellandrene	4.52*	1026	[1.08]	3.33*	1167	0.82
1,8-Cineole	4.52*	1026	[1.08]	3.33*	1167	[0.82]
Lavender lactone	4.60	1032	0.03	9.24	1606	0.04
Benzyl alcohol	4.66	1035	0.02	11.78	1818	0.01
(Z)-β-Ocimene	4.73	1040	2.82	3.82	1205	2.87
(E)-β-Ocimene	4.89	1050	2.97	4.02*	1220	[3.98]
γ-Terpinene	5.00	1057	0.10	3.84	1207	0.07
cis-Sabinene hydrate	5.11	1064	0.05	6.96*	1432	0.22
cis-Linalool oxide (fur.)	5.21	1070	0.23	6.58	1404	0.23
Octanol	5.30	1076	0.03	8.26	1530	0.03
α-Pinene oxide analog	5.34	1078	0.02	5.45	1322	0.02
Terpinolene	5.46*	1086	0.23	4.32*	1241	[0.39]
trans-Linalool oxide (fur.)	5.46*	1086	[0.23]	6.96*	1432	[0.22]
Rosefuran	5.64	1097	0.03	6.04	1365	0.02
Linalool	5.78	1106	28.89	8.17*†	1523	64.73
(Z)-6-Methyl-3,5-heptadien-2-one	5.83	1109	0.20	8.24*†	1528	[64.73]
Octen-3-yl acetate	5.94*	1117	1.02	5.83*†	1350	[1.02]
Unknown [m/z 82, 81 (72), 43 (64), 54 (32), 41 (20)...]	5.94*	1117	[1.02]	9.60*	1636	0.07
Octan-3-yl acetate	6.12	1128	0.09	5.26	1309	0.12
allo-Ocimene	6.16	1131	0.07	5.61	1334	0.06
(Z)-Myroxide	6.24†	1136	0.53	6.89	1427	0.04
Camphor	6.26†	1137	[0.53]	7.25	1454	0.39
(E)-Myroxide	6.34	1142	0.02	7.11	1443	0.02
trans-Verbenol	6.35	1143	0.03	9.57*	1633	1.65
Hexyl isobutyrate	6.50	1152	0.06	5.35	1315	0.05
Borneol	6.65*	1162	1.07	9.84*†	1655	[2.38]
cis-Linalool oxide (pyr.)	6.65*	1162	[1.07]	10.34	1696	0.04
Lavandulol	6.75	1169	0.90	9.67	1641	0.86
Terpinen-4-ol	6.85	1176	2.59	8.64	1559	2.65
meta-Cymen-8-ol	6.93*	1181	0.26	11.56	1799	0.13
Cryptone	6.93*	1181	[0.26]	9.22*	1604	0.18
para-Cymen-8-ol	6.99	1185	0.10	11.60	1802	0.08
α-Terpineol	7.07*	1190	0.93	9.84*†	1655	[2.38]
Myrtenal	7.07*	1190	[0.93]	8.72	1566	0.08
Hodiendiol	7.14	1195	0.04	12.86	1914	0.04
Hexyl butyrate	7.17	1197	0.36	6.32	1385	0.30
Unknown [m/z 43, 71 (66), 59 (52), 41 (47), 68 (46)...]	7.32	1206	0.05	6.28	1382	0.03
(3E,5E)-2,6-Dimethylocta-3,5,7-trien-2-ol	7.42	1214	0.06	11.41	1786	0.07

<i>trans</i> -Carveol	7.48	1217	0.03	11.46	1789	0.02
Bornyl formate	7.58	1225	0.05	8.02	1512	0.05
Nerol	7.69	1232	0.17	11.12*	1761	0.21
Hexyl 2-methylbutyrate	7.76*	1237	0.07	6.51	1399	0.05
Cuminal	7.76*	1237	[0.07]	10.64	1721	0.02
Carvone	7.84*	1242	0.07	10.04	1671	0.04
Neral	7.84*	1242	[0.07]	9.53	1630	0.02
Hexyl isovalerate	7.84*	1242	[0.07]	6.76	1418	0.02
Linalyl acetate	8.19*	1266	36.54	8.17*†	1523	[64.73]
Geraniol	8.19*	1266	[36.54]	11.69	1810	0.44
Geranial	8.30	1274	0.04	10.18	1682	0.04
2,6-Dimethyl-1,7-octadiene-3,6-diol	8.38	1280	0.04	14.71	2088	0.04
Bornyl acetate	8.49	1288	0.13	8.31*	1534	0.67
Cuminol	8.59	1294	0.02	14.25	2044	0.03
Lavandulyl acetate	8.65	1299	2.84	8.82	1573	2.81
Hexyl tiglate	9.21	1332	0.06	8.94	1582	0.05
Hodiendiol derivative	9.33	1341	0.04	12.99	1925	0.05
Unknown [m/z 43, 79 (47), 71 (31), 94 (27), 81 (23), 41 (22)... 197 (0)]	9.48	1352	0.03	11.12*	1761	[0.21]
Unknown [m/z 43, 79 (46), 71 (30), 94 (25), 41 (23), 81 (21)... 197 (0)]	9.53	1355	0.03	11.20	1768	0.03
Hodiendiol derivative III	9.64	1362	0.01	12.80*	1908	0.42
Neryl acetate	9.68	1366	0.30	10.22	1685	0.31
$\alpha$ -Copaene	9.77	1372	0.02	7.18	1449	0.02
7-Cubebene epimer?	9.83	1376	0.02	7.29	1456	0.01
$\beta$ -Bourbonene	9.89	1380	0.06	7.52	1474	0.04
Geranyl acetate	9.96	1385	0.53	10.59*	1716	0.58
Hexyl hexanoate	10.01*	1389	0.14	8.90	1580	0.10
7-epi-Sesquithujene	10.01*	1389	[0.14]	7.91	1503	0.07
Isocaryophyllene	10.19	1401	0.04	8.24*†	1528	[64.73]
Sesquithujene	10.26	1406	0.08	8.17*†	1523	[64.73]
$\beta$ -Caryophyllene	10.36*	1414	3.89	8.49*	1548	3.98
<i>cis</i> - $\alpha$ -Bergamotene	10.36*	1414	[3.89]	8.31*	1534	[0.67]
$\alpha$ -Santalene	10.41	1418	0.57	8.31*	1534	[0.67]
Lavandulyl isobutyrate	10.47	1422	0.10	9.38	1618	0.08
<i>trans</i> - $\alpha$ -Bergamotene	10.63	1434	0.15	8.49*	1548	[3.98]
<i>cis</i> - $\beta$ -Bergamotene?	10.75*	1443	0.10			
Sesquisabinene A	10.75*	1443	[0.10]	9.22*	1604	[0.18]
$\alpha$ -Humulene	10.81	1448	0.23	9.31	1612	0.12

Lavandulyl butyrate?	10.92	1455	0.17			
(E)-β-Farnesene	10.96*	1459	1.64	9.57*	1633	[1.65]
β-Santalene	10.96*	1459	[1.64]	9.16	1600	0.02
Germacrene D	11.20	1476	0.39	9.80†	1652	2.38
trans-β-Bergamotene	11.28	1482	0.07	9.60*	1636	[0.07]
β-Bisabolene	11.62	1508	0.04	10.15	1679	0.01
Lavandulyl isovalerate	11.65*	1510	0.14	10.69	1725	0.05
γ-Cadinene	11.65*	1510	[0.14]	10.42	1702	0.14
β-Sesquiphellandrene	11.80	1522	0.04	10.59*	1716	[0.58]
Isocaryophyllene epoxide B	12.09	1545	0.04	12.16	1852	0.05
(E)-Nerolidol	12.34	1564	0.01	13.81	2002	0.01
Caryophyllene oxide isomer	12.47*	1575	0.52	12.72	1901	0.07
Caryophyllene oxide	12.47*	1575	[0.52]	12.80*	1908	[0.42]
Humulene epoxide I	12.67	1590	0.11	13.28	1953	0.11
Humulene epoxide II	12.81	1601	0.02	13.37	1960	0.08
τ-Cadinol	13.24	1636	0.07	14.93	2109	0.09
(3Z)-Caryophylla-3,8(13)-dien-5β-ol	13.61	1667	0.02	16.86	2306	0.02
cis-14-nor-Muurolo-5-en-4-one?	13.73	1676	0.02	15.76	2191	0.02
α-Bisabolol	13.78	1681	0.03	15.45	2160	0.04
Herniarin	14.12	1710	0.01	21.24	2811	0.02
9-(15,16-Dihydro-15-methylenegeranyl)-α-terpinene	17.54	2021	0.04	15.88	2204	0.05
<b>Total identified</b>		<b>98.27%</b>			<b>97.44%</b>	
<b>Total reported</b>		<b>98.38%</b>			<b>97.51%</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