

## GC/MS BATCH NUMBER: L20103

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**ESSENTIAL OIL:** LAVANDIN  
**BOTANICAL NAME:** LAVANDULA X INTERMEDIA  
**ORIGIN:** FRANCE

KEY CONSTITUENTS PRESENT IN THIS BATCH OF LAVANDIN OIL	%
LINALOOL	35.9
GERANIOL + LINALYL ACETATE	26.4
CAMPHOR	6.8
1,8-CINEOLE + $\beta$ -PHELLANDRENE	4.7
TERPINEN-4-ol	4.1
BORNEOL	3.0
LAVANDULYL ACETATE	2.5
$\beta$ -CARYOPHYLLENE	1.5
(E)- $\beta$ -FARNESENE	1.2

Comments from Robert Tisserand: Beautiful sweet, fresh-green odor quality. All fourteen key ISO constituents are within range.

Date : July 25, 2018

CERTIFICATE OF ANALYSIS – GC PROFILING

SAMPLE IDENTIFICATION

**Internal code :** 18G19-PTH2-1-CC

**Customer identification :** Lavandin - France - L2010384R

**Type :** Essential oil

**Source :** *Lavandula x intermedia* cv. Grosso

**Customer :** Plant Therapy


ANALYSIS

**Method:** PC-PA-014-17J19 - Analysis of the composition of an essential oil, or other volatile liquid, by FAST GC-FID (in French); identifications validated by GC-MS.

**Analyst :** Sarah-Eve Tremblay, M. Sc. A., Chimiste

**Analysis date :** July 20, 2018

Checked and approved by :



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

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*PHYSICOCHEMICAL DATA*

**Physical aspect:** Clear liquid

**Refractive index:**  $1.4603 \pm 0.0003$  (20 °C)

*CONCLUSION*

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

## ANALYSIS SUMMARY

Identification	DB-5 (%)	DB-WAX (%)	Classe
Methacrolein	tr	tr	Aliphatic aldehyde
3-Buten-2-one	tr	tr	Aliphatic ketone
2-Methyl-3-buten-2-ol	0.01	tr	Aliphatic alcohol
Isovaleral	0.01	0.02	Aliphatic aldehyde
2-Methylbutyral	tr	tr	Aliphatic aldehyde
Isoamyl alcohol	tr	0.02	Aliphatic alcohol
Toluene	tr	0.09*	Simple phenolic
Prenal	tr	0.71*	Aliphatic aldehyde
Hexanal	0.01	0.01	Aliphatic aldehyde
Methyl hexyl ether	0.04	0.03	Aliphatic ether
(2E)-Hexenal	0.01	0.01	Aliphatic aldehyde
(3Z)-Hexenol	0.06	0.06	Aliphatic alcohol
Hexanol	0.16	0.17*	Aliphatic alcohol
Hashishene	tr	0.41*	Monoterpene
Tricyclene	0.01	0.02	Monoterpene
$\alpha$ -Thujene	0.09	[0.09]*	Monoterpene
$\alpha$ -Pinene	0.41	[0.41]*	Monoterpene
Camphene	0.28*	0.28	Monoterpene
$\alpha$ -Fenchene	[0.28]*	tr	Monoterpene
Thuja-2,4(10)-diene	0.01	0.12*	Monoterpene
Butyl isobutyrate	0.01	0.01	Aliphatic ester
$\beta$ -Pinene	0.44*	0.33	Monoterpene
Sabinene	[0.44]*	[0.12]*	Monoterpene
Octen-3-ol	0.22	0.23	Aliphatic alcohol
Octan-3-one	0.04*	0.03	Aliphatic ketone
6-Methyl-5-hepten-2-one	[0.04]*	0.01	Aliphatic ketone
Myrcene	0.57	0.57	Monoterpene
Butyl butyrate	0.04*	0.03	Aliphatic ester
Octan-3-ol	[0.04]*	0.01	Aliphatic alcohol
Pseudolimonene	0.02*	tr	Monoterpene
$\alpha$ -Phellandrene	[0.02]*	0.02	Monoterpene
<i>cis</i> -Dehydroxylinalool oxide	0.02	0.15*	Monoterpenic ether
$\Delta^3$ -Carene	0.05	0.04	Monoterpene
(3Z)-Hexenyl acetate	0.01	tr	Aliphatic ester
$\alpha$ -Terpinene	0.05	0.05	Monoterpene
Hexyl acetate	0.15	0.37*	Aliphatic ester
ortho-Cymene	0.01	0.15*	Simple phenolic
para-Cymene	0.14	[0.15]*	Monoterpene
Limonene	5.44*	[0.71]*	Monoterpene
1,8-Cineole	[5.44]*	4.71*	Monoterpenic ether
$\beta$ -Phellandrene	[5.44]*	[4.71]*	Monoterpene
Lavender lactone	0.02	0.01	Aliphatic lactone
(Z)- $\beta$ -Ocimene	0.52	0.53	Monoterpene
(E)- $\beta$ -Ocimene	0.28	0.26	Monoterpene
$\gamma$ -Terpinene	0.14	[0.15]*	Monoterpene
<i>cis</i> -Sabinene hydrate	0.09	0.20*	Monoterpenic alcohol
<i>cis</i> -Linalool oxide (fur.)	0.14	0.14	Monoterpenic alcohol
$\alpha$ -Pinene oxide analog	0.12*	[0.17]*	Monoterpenic ether

Octanol	[0.12]*	26.12*	Aliphatic alcohol
Terpinolene	0.35*	[0.37]*	Monoterpene
<i>trans</i> -Linalool oxide (fur.)	[0.35]*	[0.20]*	Monoterpenic alcohol
<i>trans</i> -Sabinene hydrate	0.02	0.14*	Monoterpenic alcohol
Linalool	35.91	36.02*	Monoterpenic alcohol
( <i>Z</i> )-6-Methyl-3,5-heptadien-2-one	0.07	0.09*	Aliphatic ketone
Octen-3-yl acetate	0.23	0.22	Aliphatic ester
Unknown	0.02	0.03	Unknown
$\alpha$ -Campholenal	0.03	0.03	Monoterpenic aldehyde
Octan-3-yl acetate	0.03*	0.04	Aliphatic ester
allo-Ocimene	[0.03]*	0.01	Monoterpene
Camphor	6.79	6.70*	Monoterpenic ketone
Camphene hydrate	0.04	1.59*	Monoterpenic alcohol
Hexyl isobutyrate	0.19	0.18	Aliphatic ester
Nerol oxide	0.01	0.01	Aliphatic ether
Borneol	2.99	4.04*	Monoterpenic alcohol
$\delta$ -Terpineol	0.10	0.10	Monoterpenic alcohol
Lavandulol	0.95	2.15*	Monoterpenic alcohol
Terpinen-4-ol	4.12*	4.10	Monoterpenic alcohol
( <i>3E,5E</i> )-Undeca-1,3,5-triene	[4.12]*	0.01	Alkene
meta-Cymen-8-ol	0.02	0.05	Monoterpenic alcohol
Cryptone	0.02	0.02	Normoterpenic ketone
para-Cymen-8-ol	0.08	0.38*	Monoterpenic alcohol
$\alpha$ -Terpineol	0.99	[4.04]*	Monoterpenic alcohol
Myrtenal	0.03	tr	Monoterpenic aldehyde
Hexyl butyrate	0.55*	0.48	Aliphatic ester
Hodiendiol	[0.55]*	0.10*	Monoterpenic alcohol
Verbenone	0.04	[2.15]*	Monoterpenic ketone
Octyl acetate	0.03	0.03	Aliphatic ester
Bornyl formate	0.04		Monoterpenic ester
Nerol	0.15	0.15	Monoterpenic alcohol
Hexyl 2-methylbutyrate	0.01	0.08	Aliphatic ester
Carvone	0.09*	0.04*	Monoterpenic ketone
Neral	[0.09]*	0.02	Monoterpenic aldehyde
Hexyl isovalerate	0.19	0.19	Aliphatic ester
Geraniol	26.44*	[0.38]*	Monoterpenic alcohol
Linalyl acetate	[26.44]*	[26.12]*	Monoterpenic ester
<i>trans</i> -Ascaridole glycol	0.01	0.01	Monoterpenic alcohol
Geranial	0.01	0.01	Monoterpenic aldehyde
Cuminol	tr	tr	Monoterpenic alcohol
Lavandulyl acetate	2.49	2.55	Monoterpenic ester
Hexyl tiglate	0.19	0.24*	Aliphatic ester
Hodiendiol derivative	0.03	0.03	Oxygenated monoterpene
Unknown	0.02	0.02	Oxygenated monoterpene
Unknown	0.02	0.01	Oxygenated monoterpene
Neryl acetate	0.25	0.34*	Monoterpenic ester
7-Cubebene	0.01*	tr	Sesquiterpene
$\alpha$ -Copaene	[0.01]*	0.01	Sesquiterpene
7-Cubebene epimer?	0.07	0.07	Aliphatic alcohol
Daucene	0.10*	[6.70]*	Sesquiterpene
$\beta$ -Bourbonene	[0.10]*	0.09	Sesquiterpene
Unknown	0.49*	[0.14]*	Sesquiterpene

Geranyl acetate	[0.49]*	0.60*	Monoterpenic ester
Hexyl hexanoate	0.13*	[0.24]*	Aliphatic ester
7-epi-Sesquithujene	[0.13]*	0.01	Sesquiterpene
$\alpha$ -Funebrene	0.02	[0.14]*	Sesquiterpene
Isocaryophyllene	tr	[0.09]*	Sesquiterpene
$\alpha$ -Gurjunene	0.03*	0.03	Sesquiterpene
Sesquithujene	[0.03]*	[36.02]*	Sesquiterpene
<i>cis</i> - $\alpha$ -Bergamotene	1.52*	0.01	Sesquiterpene
$\beta$ -Caryophyllene	[1.52]*	[1.59]*	Sesquiterpene
$\alpha$ -Santalene	0.17	0.23	Sesquiterpene
Lavandulyl isobutyrate	0.08	0.11*	Monoterpenic ester
Coumarin	0.07		Coumarin
<i>trans</i> - $\alpha$ -Bergamotene	0.13	[1.59]*	Sesquiterpene
Isogermacrene D	0.01	0.04	Sesquiterpene
Sesquisabinene A	0.08*	0.06*	Sesquiterpene
<i>cis</i> - $\beta$ -Bergamotene?	[0.08]*		Sesquiterpene
$\alpha$ -Humulene	0.05	[0.11]*	Sesquiterpene
Lavandulyl butyrate?	0.07*	[0.60]*	Monoterpenic ester
$\beta$ -Santalene	[0.07]*	0.06	Sesquiterpene
( <i>E</i> )- $\beta$ -Farnesene	1.21	[2.15]*	Sesquiterpene
Dauca-5,8-diene?	0.05	[0.06]*	Sesquiterpene
<i>trans</i> -Cadina-1(6),4-diene	0.09	0.02	Sesquiterpene
Germacrene D	0.44	0.44	Sesquiterpene
<i>trans</i> - $\beta$ -Bergamotene	0.04	[2.15]*	Sesquiterpene
Isodaucene	0.06	[0.04]*	Sesquiterpene
$\alpha$ -Murolene	0.05	0.03	Sesquiterpene
$\beta$ -Bisabolene	0.68*	[0.34]*	Sesquiterpene
Lavandulyl isovalerate	[0.68]*	0.30	Monoterpenic ester
$\gamma$ -Cadinene	[0.68]	0.21	Sesquiterpene
$\delta$ -Cadinene	0.02	0.02	Sesquiterpene
$\beta$ -Sesquiphellandrene	0.09	0.09	Sesquiterpene
Isocaryophyllene epoxide B	0.02	0.01	Sesquiterpenic ether
Dendrolasin	tr	tr	Sesquiterpenic ether
Caryophyllene oxide	0.10*	[0.10]*	Sesquiterpenic ether
Caryophyllene oxide isomer	[0.10]*	0.02	Sesquiterpenic ether
Humulene epoxide II	tr	tr	Sesquiterpenic ether
$\tau$ -Cadinol	0.09	0.09	Sesquiterpenic alcohol
$\alpha$ -Bisabolol	0.22	0.21	Sesquiterpenic alcohol
<b>Total identified</b>	<b>99.28%</b>	<b>98.80%</b>	

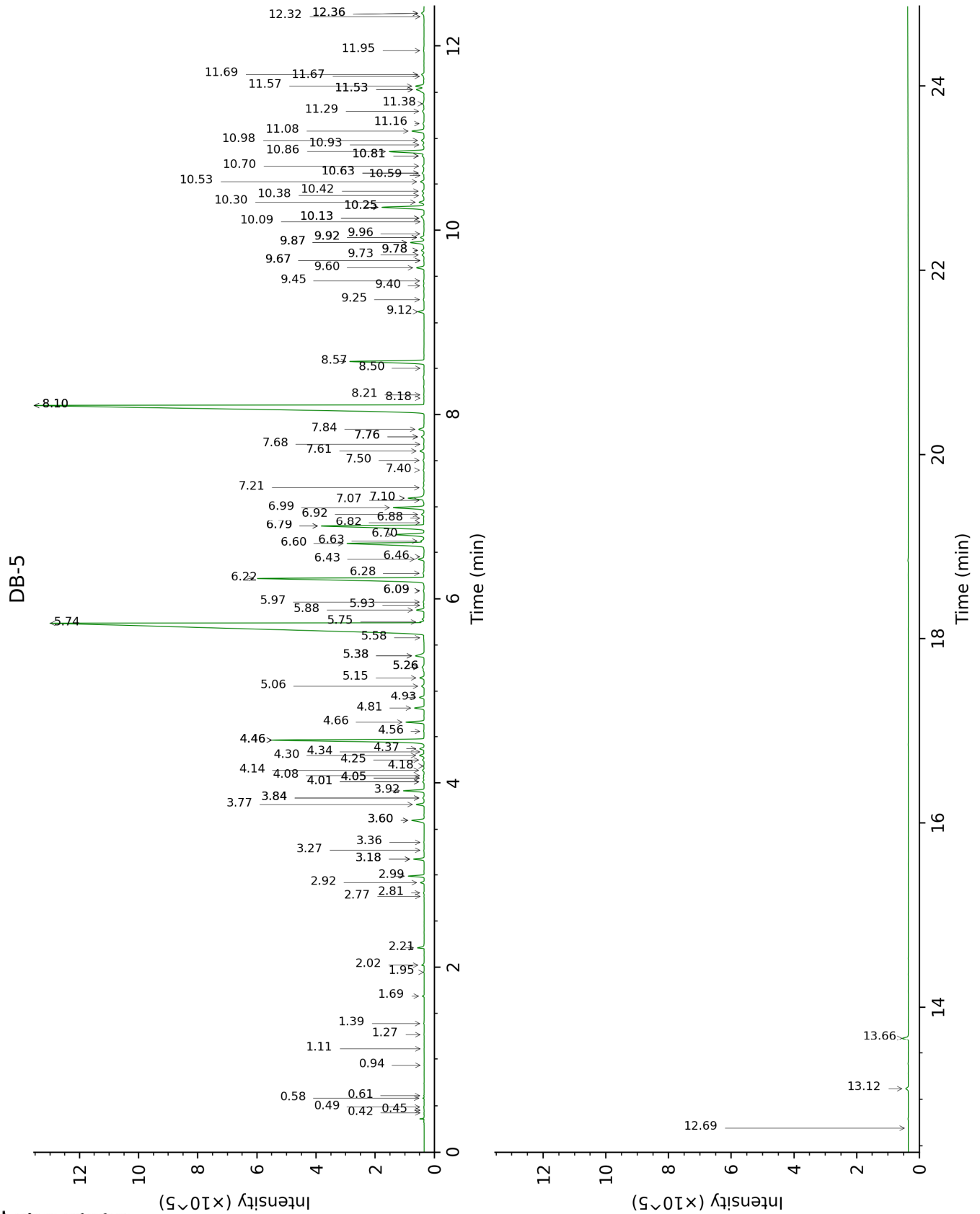
\*: Two or more compounds are coeluting on this column

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

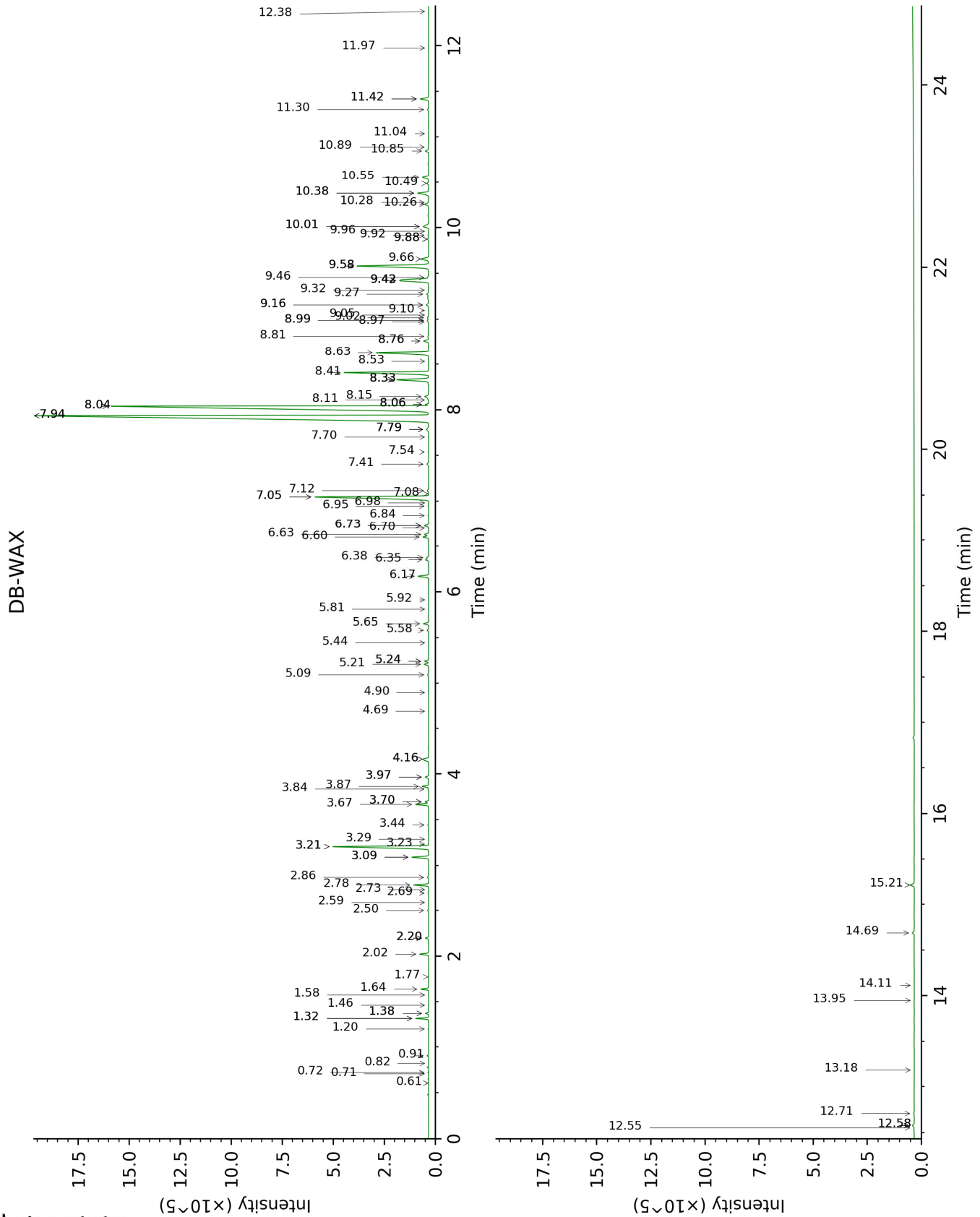
tr: The compound has been detected below 0.005% of total signal.

Note: no correction factor was applied

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FULL ANALYSIS DATA

Identification	Column DB-5			Column DB-WAX		
	R.T	R.I	%	R.T	R.I	%
Methacrolein	0.42	553	tr	0.61	837	tr
3-Buten-2-one	0.45	580	tr	0.82	911	tr
2-Methyl-3-buten-2-ol	0.49	606	0.01	1.46	1013	tr
Isovaleral	0.58	640	0.01	0.72	880	0.02
2-Methylbutyral	0.61	649	tr	0.71	874	tr
Isoamyl alcohol	0.94	728	tr	3.29	1176	0.02
Toluene	1.11	755	tr	1.38*	1002	0.09
Prenal	1.27	778	tr	3.09*	1160	0.71
Hexanal	1.39	796	0.01	1.77	1044	0.01
Methyl hexyl ether	1.69	824	0.04	0.90	925	0.03
(2E)-Hexenal	1.95	847	0.01	3.23	1171	0.01
(3Z)-Hexenol	2.02	853	0.06	5.58	1344	0.06
Hexanol	2.21	869	0.16	5.24*	1320	0.17
Hashishene	2.77	914	tr	1.32*	992	0.41
Tricyclene	2.81	916	0.01	1.20	974	0.02
α-Thujene	2.92	924	0.09	1.38*	1002	[0.09]
α-Pinene	2.99	929	0.41	1.32*	992	[0.41]
Camphene	3.18*	942	0.28	1.64	1030	0.28
α-Fenchene	3.18*	942	[0.28]	1.58	1024	tr
Thuja-2,4(10)-diene	3.27	948	0.01	2.20*	1086	0.12
Butyl isobutyrate	3.36	954	0.01	2.59	1121	0.01
β-Pinene	3.60*	970	0.44	2.02	1068	0.33
Sabinene	3.60*	970	[0.44]	2.20*	1086	[0.12]
Octen-3-ol	3.77	981	0.22	6.60	1418	0.23
Octan-3-one	3.84*	986	0.04	3.84	1218	0.03
6-Methyl-5-hepten-2-one	3.84*	986	[0.04]	4.90	1295	0.01
Myrcene	3.92	991	0.57	2.78	1136	0.57
Butyl butyrate	4.01*	998	0.04	3.44	1188	0.03
Octan-3-ol	4.01*	998	[0.04]	5.92	1368	0.01
Pseudolimonene	4.06*	1001	0.02	2.73	1132	tr
α-Phellandrene	4.06*	1001	[0.02]	2.69	1129	0.02
cis-Dehydroxylinalool oxide	4.08	1002	0.02	3.70*	1208	0.15
Δ3-Carene	4.14	1006	0.05	2.50	1114	0.04
(3Z)-Hexenyl acetate	4.18	1009	0.01	4.69	1279	tr
α-Terpinene	4.25	1013	0.05	2.86	1142	0.05
Hexyl acetate	4.30	1016	0.15	4.16*	1241	0.37
ortho-Cymene	4.34	1019	0.01	3.97*	1227	0.15
para-Cymene	4.37	1021	0.14	3.97*	1227	[0.15]
Limonene	4.46*	1027	5.44	3.09*	1160	[0.71]
1,8-Cineole	4.46*	1027	[5.44]	3.21*	1169	4.71
β-Phellandrene	4.46*	1027	[5.44]	3.21*	1169	[4.71]
Lavender lactone	4.56	1033	0.02	9.05	1606	0.01
(Z)-β-Ocimene	4.66	1039	0.52	3.67	1205	0.53

(E)-β-Ocimene	4.81	1049	0.28	3.87	1220	0.26
γ-Terpinene	4.93	1056	0.14	3.70*	1208	[0.15]
cis-Sabinene hydrate	5.06	1064	0.09	6.73*	1428	0.20
cis-Linalool oxide (fur.)	5.15	1070	0.14	6.35	1400	0.14
α-Pinene oxide analog	5.26*†	1077	0.12	5.24*	1320	[0.17]
Octanol	5.26*†	1077	[0.12]	8.04*	1527	26.12
Terpinolene	5.38*	1085	0.35	4.16*	1241	[0.37]
trans-Linalool oxide (fur.)	5.38*	1085	[0.35]	6.73*	1428	[0.20]
trans-Sabinene hydrate	5.58	1097	0.02	7.79*	1507	0.14
Linalool	5.74	1107	35.91	7.94*	1519	36.02
(Z)-6-Methyl-3,5-heptadien-2-one	5.75	1108	0.07	8.06*	1528	0.09
Octen-3-yl acetate	5.88	1116	0.23	5.65	1349	0.22
Unknown [m/z 82, 81 (72), 43 (64), 54 (32), 41 (20)...]	5.93	1120	0.02	9.46	1639	0.03
α-Campholenal	5.97	1122	0.03	6.84	1436	0.03
Octan-3-yl acetate	6.09*	1130	0.03	5.09	1309	0.04
allo-Ocimene	6.09*	1130	[0.03]	5.44	1334	0.01
Camphor	6.22	1138	6.79	7.05*	1452	6.70
Camphene hydrate	6.28	1142	0.04	8.33*	1550	1.59
Hexyl isobutyrate	6.43	1152	0.19	5.21	1317	0.18
Nerol oxide	6.46	1154	0.01	6.70	1426	0.01
Borneol	6.60	1163	2.99	9.58*	1649	4.04
δ-Terpineol	6.63	1164	0.10	9.27	1624	0.10
Lavandulol	6.70	1169	0.95	9.42*	1636	2.15
Terpinen-4-ol	6.79*	1175	4.12	8.41	1556	4.10
(3E,5E)-Undeca-1,3,5-triene	6.79*	1175	[4.12]	5.81	1361	0.01
meta-Cymen-8-ol	6.82	1177	0.02	11.30	1794	0.05
Cryptone	6.88	1181	0.02	8.97	1600	0.02
para-Cymen-8-ol	6.92	1183	0.08	11.42*	1804	0.38
α-Terpineol	6.99	1188	0.99	9.58*	1649	[4.04]
Myrtenal	7.07	1193	0.03	8.53	1565	tr
Hexyl butyrate	7.10*	1195	0.55	6.17	1387	0.48
Hodiendiol	7.10*	1195	[0.55]	12.58*	1908	0.10
Verbenone	7.21	1202	0.04	9.42*	1636	[2.15]
Octyl acetate	7.40	1215	0.03	6.95	1444	0.03
Bornyl formate	7.50	1222	0.04			
Nerol	7.61	1229	0.15	10.85	1755	0.15
Hexyl 2-methylbutyrate	7.68	1234	0.01	6.38	1402	0.08
Carvone	7.76*	1239	0.09	9.88*	1674	0.04
Neral	7.76*	1239	[0.09]	9.32	1628	0.02
Hexyl isovalerate	7.84	1244	0.19	6.63	1420	0.19
Geraniol	8.10*	1262	26.44	11.42*	1804	[0.38]
Linalyl acetate	8.10*	1262	[26.44]	8.04*	1527	[26.12]

<i>trans</i> -Ascaridole glycol	8.18	1267	0.01	13.95	2036	0.01
Geranial	8.21	1269	0.01	9.96	1680	0.01
Cuminol	8.50	1289	tr	14.11	2052	tr
Lavandulyl acetate	8.58	1294	2.49	8.63	1573	2.55
Hexyl tiglate	9.12	1332	0.19	8.76*	1583	0.24
Hodiendiol derivative	9.25	1341	0.03	12.71	1920	0.03
Unknown [m/z 43, 79 (47), 71 (31), 94 (27), 81 (23), 41 (22)... 197 (0)]	9.40	1352	0.02	10.89	1759	0.02
Unknown [m/z 43, 79 (46), 71 (30), 94 (25), 41 (23), 81 (21)... 197 (0)]	9.45	1355	0.02	11.04	1771	0.01
Neryl acetate	9.60	1365	0.25	10.01*	1685	0.34
7-Cubebene	9.67*	1371	0.01	6.98	1447	tr
$\alpha$ -Copaene	9.67*	1371	[0.01]	7.08	1454	0.01
7-Cubebene epimer?	9.74	1375	0.07	7.12	1457	0.07
Daucene	9.78*	1379	0.10	7.05*	1452	[6.70]
$\beta$ -Bourbonene	9.78*	1379	[0.10]	7.41	1479	0.09
Unknown [m/z 161, 91 (40), 105 (38), 79 (31), 93 (29), 119 (29)... 204 (1)]	9.87*	1385	0.49	7.79*	1507	[0.14]
Geranyl acetate	9.87*	1385	[0.49]	10.38*	1715	0.60
Hexyl hexanoate	9.92*	1389	0.13	8.76*	1583	[0.24]
7-epi-Sesquithujene	9.92*	1389	[0.13]	7.70	1501	0.01
$\alpha$ -Funebrene	9.96	1391	0.02	7.79*	1507	[0.14]
Isocaryophyllene	10.09	1401	tr	8.06*	1528	[0.09]
$\alpha$ -Gurjunene	10.13*	1403	0.03	7.54	1489	0.03
Sesquithujene	10.13*	1403	[0.03]	7.94*	1519	[36.02]
<i>cis</i> - $\alpha$ -Bergamotene	10.25*	1412	1.52	8.11	1532	0.01
$\beta$ -Caryophyllene	10.25*	1412	[1.52]	8.33*	1550	[1.59]
$\alpha$ -Santalene	10.30	1416	0.17	8.15	1535	0.23
Lavandulyl isobutyrate	10.38	1422	0.08	9.16*	1614	0.11
Coumarin	10.42	1425	0.07			
<i>trans</i> - $\alpha$ -Bergamotene	10.53	1433	0.13	8.33*	1550	[1.59]
Isogermacrene D	10.59	1438	0.01	8.81	1587	0.04
Sesquisabinene A	10.63*	1440	0.08	8.99*	1601	0.06
<i>cis</i> - $\beta$ -Bergamotene?	10.63*	1440	[0.08]			
$\alpha$ -Humulene	10.70	1446	0.05	9.16*	1614	[0.11]
Lavandulyl butyrate?	10.81*	1454	0.07	10.38*	1715	[0.60]
$\beta$ -Santalene	10.81*	1454	[0.07]	9.02	1603	0.06
( <i>E</i> )- $\beta$ -Farnesene	10.86	1458	1.21	9.42*	1636	[2.15]
Dauca-5,8-diene?	10.93	1463	0.05	8.99*	1601	[0.06]

<i>trans</i> -Cadina-1(6),4-diene	10.98	1467	0.09	9.10	1610	0.02
Germacrene D	11.08	1474	0.44	9.66	1656	0.44
<i>trans</i> - $\beta$ -Bergamotene	11.16	1480	0.04	9.42*	1636	[2.15]
Isodaucene	11.30	1490	0.06	9.88*	1674	[0.04]
$\alpha$ -Muurolene	11.38	1496	0.05	9.92	1677	0.03
$\beta$ -Bisabolene	11.53*†	1508	0.68	10.01*	1685	[0.34]
Lavandulyl isovalerate	11.53*†	1508	[0.68]	10.55	1730	0.30
$\gamma$ -Cadinene	11.57†	1511	[0.68]	10.26	1705	0.21
$\delta$ -Cadinene	11.67	1519	0.02	10.28	1706	0.02
$\beta$ -Sesquiphellandrene	11.69	1521	0.09	10.49	1724	0.09
Isocaryophyllene epoxide B	11.95	1541	0.02	11.98	1854	0.01
Dendrolasin	12.32	1570	tr	12.38	1889	tr
Caryophyllene oxide	12.36*	1573	0.10	12.58*	1908	[0.10]
Caryophyllene oxide isomer	12.36*	1573	[0.10]	12.55	1905	0.02
Humulene epoxide II	12.69	1600	tr	13.18	1964	tr
$\tau$ -Cadinol	13.12	1635	0.09	14.69	2108	0.09
$\alpha$ -Bisabolol	13.66	1680	0.22	15.21	2161	0.21
<b>Total identified</b>		<b>99.28%</b>			<b>98.80%</b>	
<b>Total reported</b>		<b>99.34%</b>			<b>98.87%</b>	

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

[xx]: Duplicate percentage due to coelutions, not taken account in the identified 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