

Date : December 14, 2018

CERTIFICATE OF ANALYSIS – GC PROFILING

SAMPLE IDENTIFICATION

Internal code : 18L05-PTH01-1-CC

Customer identification : Lavender - Bulgarian - L4011288R

Type : Essential oil

Source : *Lavandula angustifolia*

Customer : Plant Therapy

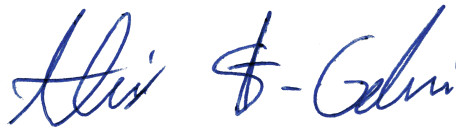
ANALYSIS

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 : Sylvain Mercier, M. Sc., Chimiste

Analysis date : December 06, 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: 1.4605 ± 0.0003 (20 °C)

ISO 3515:2004 - OIL OF CLONAL LAVENDER - BULGARIA

Compound	Min. %	Max. %	Observed %	Complies?
α-Terpineol	0.8	2.0	0.9	Yes
Lavandulyl acetate	2	5	2	Yes
Terpinen-4-ol	2	5	3	Yes
Lavandulol	0.3		0.8	Yes
Linalyl acetate	30	42	32	Yes
Linalool	22	34	33	Yes
Camphor		0.6	0.2	Yes
Octan-3-one	0.2	1.6	1.0	Yes
(E)-β-Ocimene	2	5	2	Yes
(Z)-β-Ocimene	3	9	4	Yes
β-Phellandrene		0.6		
1,8-Cineole		2.0	1.3*	Yes
Limonene		0.6	0.3	Yes
Refractive index	1.4590	1.4630	1.4605	Yes

*Coeluted on both columns

CONCLUSION

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

ANALYSIS SUMMARY

Identification	DB-5 (%)	DB-WAX (%)	Classe
Acetone	tr	tr	Aliphatic ketone
Methacrolein	tr		Aliphatic aldehyde
2-Methyl-3-buten-2-ol	0.02	0.01	Aliphatic alcohol
Isovaleral	0.01	0.01	Aliphatic aldehyde
2-Methylbutyral	0.01	0.01	Aliphatic aldehyde
Isoamyl alcohol	0.01	0.01*	Aliphatic alcohol
2-Methylbutanol	tr	[0.01]*	Aliphatic alcohol
Toluene	0.01	0.01	Simple phenolic
Hexanal	tr	tr	Aliphatic aldehyde
Butyl acetate	0.02	0.02	Aliphatic ester
Methyl hexyl ether	0.09	0.09	Aliphatic ether
(3Z)-Hexenol	0.04	0.77*	Aliphatic alcohol
Hexanol	0.08	0.09*	Aliphatic alcohol
Tricyclene	0.02	0.02	Monoterpene
α -Thujene	0.10	0.09	Monoterpene
α -Pinene	0.18	0.18	Monoterpene
Camphene	0.13	0.13	Monoterpene
Butyl isobutyrate	0.01	0.01	Aliphatic ester
β -Pinene	0.12	0.07	Monoterpene
Sabinene	[0.12]	0.05	Monoterpene
Octen-3-ol	0.25	0.26	Aliphatic alcohol
Octan-3-one	1.02*	1.01	Aliphatic ketone
6-Methyl-5-hepten-2-one	[1.02]*	0.01	Aliphatic ketone
Myrcene	0.62*	0.60	Monoterpene
Dehydro-1,8-cineole	[0.62]*	0.01	Monoterpenic ether
<i>trans</i> -Dehydroxylinalool oxide	[0.62]*	0.01	Monoterpenic ether
Butyl butyrate	0.29*	0.10	Aliphatic ester
Octan-3-ol	[0.29]*	0.20	Aliphatic alcohol
α -Phellandrene	0.05*	0.04	Monoterpene
Pseudolimonene	[0.05]*	0.02	Monoterpene
<i>cis</i> -Dehydroxylinalool oxide	0.01	tr	Monoterpenic ether
Δ^3 -Carene	0.18	0.18	Monoterpene
α -Terpinene	0.04	0.04	Monoterpene
Hexyl acetate	0.45	0.57*	Aliphatic ester
ortho-Cymene	0.04	0.03	Simple phenolic
para-Cymene	0.16	0.17	Monoterpene
Limonene	0.29	0.38	Monoterpene
1,8-Cineole	1.40*	1.30*	Monoterpenic ether
β -Phellandrene	[1.40]*	[1.30]*	Monoterpene
Benzyl alcohol	0.02	0.02	Simple phenolic
(Z)- β -Ocimene	4.38	4.28	Monoterpene
(E)- β -Ocimene	2.17	2.10	Monoterpene
γ -Terpinene	0.13	0.11	Monoterpene
<i>cis</i> -Sabinene hydrate	0.07	0.16*	Monoterpenic alcohol
<i>cis</i> -Linalool oxide (fur.)	0.12	0.12	Monoterpenic alcohol
Octanol	0.03	[65.63]*	Aliphatic alcohol
α -Pinene oxide analog	0.02	[0.09]*	Monoterpenic ether
Isoterpinolene	0.01	0.02	Monoterpene

Terpinolene	0.21*	[0.57]*	Monoterpene
<i>trans</i> -Linalool oxide (fur.)	[0.21]*	[0.16]*	Monoterpenic alcohol
<i>trans</i> -Sabinene hydrate	0.04*	0.04	Monoterpenic alcohol
Rosefuran	[0.04]*	0.02	Monoterpenic ether
Linalool	33.47	65.63	Monoterpenic alcohol
(<i>Z</i>)-6-Methyl-3,5-heptadien-2-one	0.04	[65.63]*	Aliphatic ketone
Octen-3-yl acetate	0.74	[0.77]*	Aliphatic ester
Unknown	0.04	0.83*	Unknown
Octan-3-yl acetate	0.08	0.11	Aliphatic ester
allo-Ocimene	0.09	0.08	Monoterpene
(<i>Z</i>)-Myroxide	0.04*	0.02	Monoterpenic ether
<i>trans</i> -Pinocarveol	[0.04]*	0.22*	Monoterpenic alcohol
Camphor	0.23	0.23	Monoterpenic ketone
(<i>E</i>)-Myroxide	0.04	0.02	Monoterpenic ether
Unknown	0.02	0.01	Oxygenated monoterpene
Hexyl isobutyrate	0.08*	0.07	Aliphatic ester
Nerol oxide	[0.08]*	0.02	Aliphatic ether
Unknown	0.01	0.01	Oxygenated monoterpene
Borneol	0.67	1.97*	Monoterpenic alcohol
Lavandulol	0.80	[0.83]*	Monoterpenic alcohol
(3 <i>E</i> ,5 <i>E</i>)-Undeca-1,3,5-triene	3.42*	0.05	Alkene
Terpinen-4-ol	[3.42]*	3.35	Monoterpenic alcohol
meta-Cymen-8-ol	0.22*	0.06	Monoterpenic alcohol
Cryptone	[0.22]*	[0.22]*	Normoterpenic ketone
para-Cymen-8-ol	0.06	0.05	Monoterpenic alcohol
Myrtenal	0.94*	0.04	Monoterpenic aldehyde
α-Terpineol	[0.94]*	[1.97]*	Monoterpenic alcohol
Hexyl butyrate	0.35	0.32	Aliphatic ester
Unknown	0.03	0.02	Unknown
Octyl acetate	0.02	0.01	Aliphatic ester
<i>trans</i> -Carveol	0.03	0.02	Monoterpenic alcohol
Bornyl formate	0.03	0.01	Monoterpenic ester
Nerol	0.16	0.16	Monoterpenic alcohol
Hexyl 2-methylbutyrate	0.09*	0.04	Aliphatic ester
Cuminal	[0.09]*	0.05	Monoterpenic aldehyde
Carvone	0.06*	0.04	Monoterpenic ketone
Neral	[0.06]*	0.03	Monoterpenic aldehyde
Hexyl isovalerate	[0.06]*	0.03	Aliphatic ester
Geraniol	32.88*	0.40	Monoterpenic alcohol
Linalyl acetate	[32.88]*	[65.63]*	Monoterpenic ester
<i>trans</i> -Ascaridole glycol	0.05	0.05	Monoterpenic alcohol
Geranial	0.07	0.37*	Monoterpenic aldehyde
2,6-Dimethyl-1,7-octadiene-3,6-diol	0.02	0.02	Monoterpenic alcohol
Bornyl acetate	0.10	0.47*	Monoterpenic ester
Lavandulyl acetate	2.42	2.42	Monoterpenic ester
Hexyl tiglate	0.05	0.04	Aliphatic ester
Hodiendiol derivative	0.03	0.05	Oxygenated monoterpene
Unknown	0.11		Oxygenated monoterpene
Unknown	0.05	0.02	Oxygenated monoterpene
Neryl acetate	0.33	[0.37]*	Monoterpenic ester
7-Cubebene	0.02	0.02	Sesquiterpene
β-Bourbonene	0.04	0.04	Sesquiterpene

Geranyl acetate	0.56	0.55	Monoterpenic ester
Hexyl hexanoate	0.14	0.08	Aliphatic ester
7-epi-Sesquithujene	[0.14]	0.07	Sesquiterpene
Isocaryophyllene	0.04	[65.63]*	Sesquiterpene
β -Caryophyllene	3.38*	3.42*	Sesquiterpene
<i>cis</i> - α -Bergamotene	[3.38]*	[0.47]*	Sesquiterpene
α -Santalene	0.31	[0.47]*	Sesquiterpene
Coumarin	0.05	0.06	Coumarin
Lavandulyl isobutyrate	0.02	0.08	Monoterpenic ester
<i>trans</i> - α -Bergamotene	0.11	[3.42]*	Sesquiterpene
Isogermacrene D	0.01	0.01	Sesquiterpene
Sesquisabinene A	0.03	0.04	Sesquiterpene
<i>cis</i> - β -Bergamotene?	0.03		Sesquiterpene
α -Humulene	0.09	0.09	Sesquiterpene
Lavandulyl butyrate?	0.08	0.11	Monoterpenic ester
β -Santalene	2.28*	[0.22]*	Sesquiterpene
(<i>E</i>)- β -Farnesene	[2.28]*	2.31	Sesquiterpene
Dauca-5,8-diene?	0.02	[0.22]*	Sesquiterpene
Germacrene D	0.37	[1.97]*	Sesquiterpene
<i>trans</i> - β -Bergamotene	0.05	[0.83]*	Sesquiterpene
Isodaucene	0.02	0.02	Sesquiterpene
β -Bisabolene	0.13*	[0.37]*	Sesquiterpene
γ -Cadinene	[0.13]*	0.12	Sesquiterpene
Lavandulyl isovalerate	0.02	0.03	Monoterpenic ester
Isocaryophyllene epoxide B	0.02	0.04	Sesquiterpenic ether
Caryophyllene oxide isomer	0.26*	0.03	Sesquiterpenic ether
Caryophyllene oxide	[0.26]*	0.25	Sesquiterpenic ether
Dendrolasin	[0.26]*	0.01	Sesquiterpenic ether
τ -Cadinol	0.06	0.09	Sesquiterpenic alcohol
(3 <i>Z</i>)-Caryophylla-3,8(13)-dien-5 β -ol	0.01	0.01	Sesquiterpenic alcohol
α -Bisabolol	0.01	tr	Sesquiterpenic alcohol
Total identified	98.62%	98.13%	

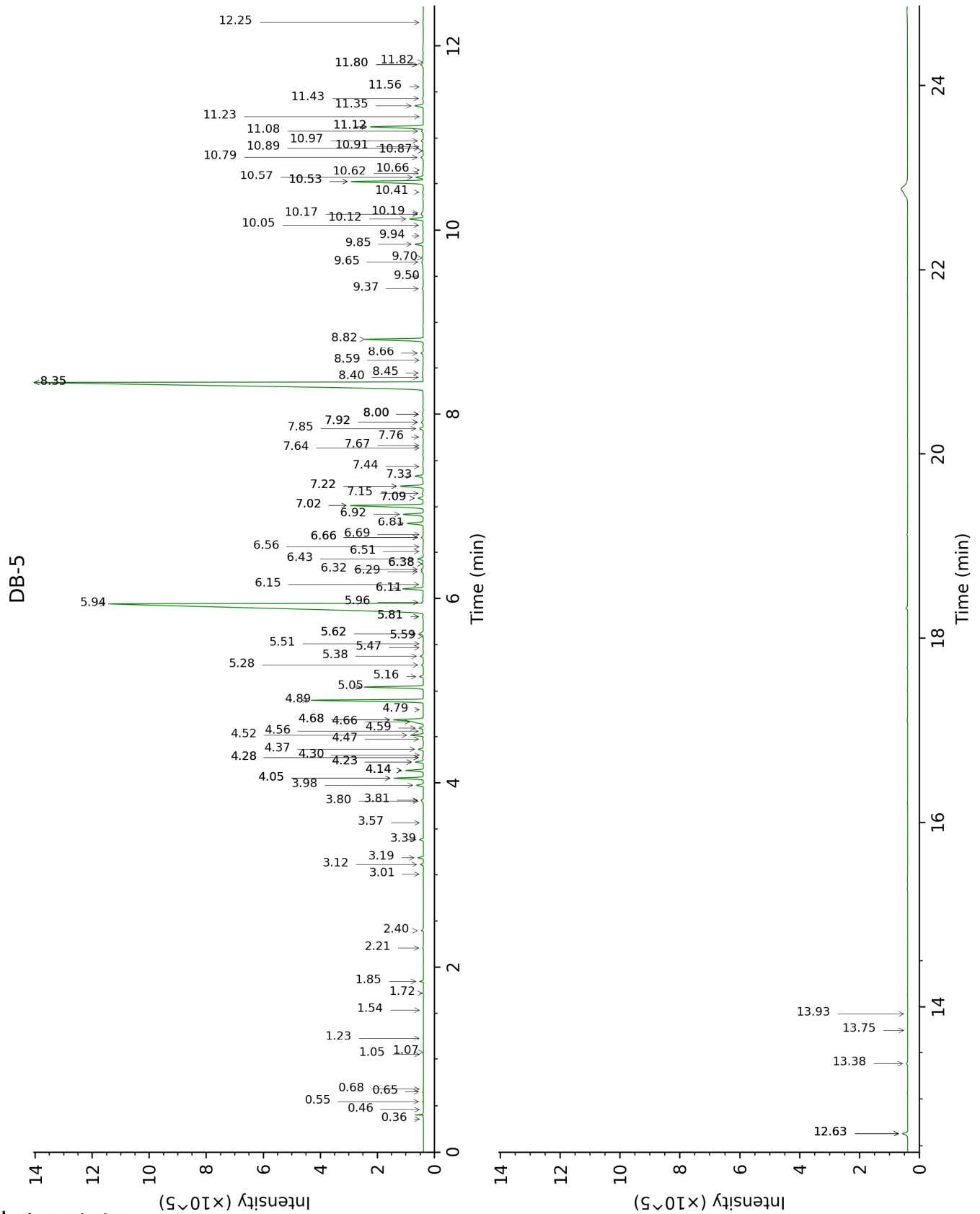
*: Two or more compounds are coeluting on this column

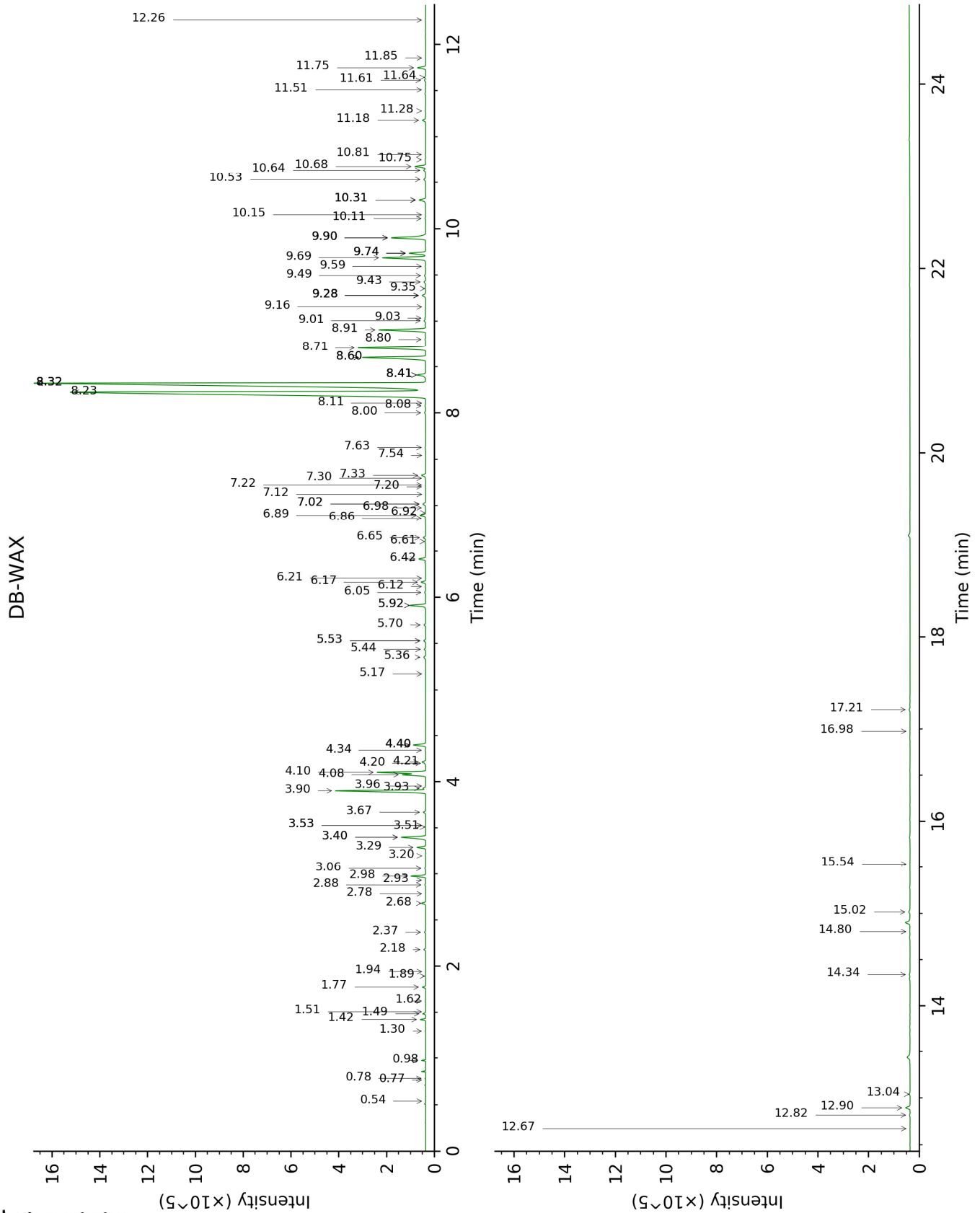
[xx]: Duplicate percentage due to coelutions, not taken account in the identified total

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	%
Acetone	0.36	515	tr	0.54	802	tr
Methacrolein	0.46	554	tr			
2-Methyl-3-buten-2-ol	0.54	606	0.02	1.62	1014	0.01
Isovaleral	0.65	641	0.01	0.78	887	0.01
2-Methylbutyral	0.68	650	0.01	0.77	882	0.01
Isoamyl alcohol	1.05	732	0.01	3.53*	1177	0.01
2-Methylbutanol	1.08	735	tr	3.53*	1177	[0.01]
Toluene	1.23	756	0.01	1.51	1003	0.01
Hexanal	1.54	797	tr	1.94	1043	tr
Butyl acetate	1.72	816	0.02	1.89	1039	0.02
Methyl hexyl ether	1.85	826	0.09	0.98	926	0.09
(3Z)-Hexenol	2.21	855	0.04	5.92*	1349	0.77
Hexanol	2.40	870	0.08	5.53*	1322	0.09
Tricyclene	3.01	917	0.02	1.30	973	0.02
α -Thujene	3.12	924	0.10	1.49	1001	0.09
α -Pinene	3.19	929	0.18	1.42	992	0.18
Camphene	3.39	942	0.13	1.77	1028	0.13
Butyl isobutyrate	3.57	954	0.01	2.78	1118	0.01
β -Pinene	3.80†	969	0.12	2.18	1066	0.07
Sabinene	3.82†	970	[0.12]	2.37	1084	0.05
Octen-3-ol	3.98	981	0.25	6.89	1420	0.26
Octan-3-one	4.05*	986	1.02	4.08	1219	1.01
6-Methyl-5-hepten-2-one	4.05*	986	[1.02]	5.17	1302	0.01
Myrcene	4.14*	991	0.62	2.98	1133	0.60
Dehydro-1,8-cineole	4.14*	991	[0.62]	3.20	1151	0.01
<i>trans</i> -Dehydroxylinalool oxide	4.14*	991	[0.62]	3.51	1175	0.01
Butyl butyrate	4.23*	997	0.29	3.67	1188	0.10
Octan-3-ol	4.23*	997	[0.29]	6.17	1367	0.20
α -Phellandrene	4.28*	1000	0.05	2.88	1126	0.04
Pseudolimonene	4.28*	1000	[0.05]	2.93	1130	0.02
<i>cis</i> -Dehydroxylinalool oxide	4.30	1002	0.01	3.96	1210	tr
Δ 3-Carene	4.36	1006	0.18	2.68	1110	0.18
α -Terpinene	4.47	1013	0.04	3.06	1140	0.04
Hexyl acetate	4.52	1016	0.45	4.40*	1243	0.57
ortho-Cymene	4.56	1018	0.04	4.20	1228	0.03
para-Cymene	4.59	1021	0.16	4.22	1229	0.17
Limonene	4.66	1025	0.29	3.29	1158	0.38
1,8-Cineole	4.68*	1026	1.40	3.40*	1167	1.30
β -Phellandrene	4.68*	1026	[1.40]	3.40*	1167	[1.30]
Benzyl alcohol	4.79	1033	0.02	11.85	1815	0.02

(Z)-β-Ocimene	4.90	1039	4.38	3.90	1206	4.28
(E)-β-Ocimene	5.05	1049	2.17	4.10	1221	2.10
γ-Terpinene	5.16	1056	0.13	3.93	1208	0.11
cis-Sabinene hydrate	5.28	1064	0.07	7.02*	1429	0.16
cis-Linalool oxide (fur.)	5.38	1070	0.12	6.65	1402	0.12
Octanol	5.47	1076	0.03	8.32*†	1527	[65.63]
α-Pinene oxide analog	5.51	1078	0.02	5.53*	1322	[0.09]
Isoterpinolene	5.59	1083	0.01	4.34	1239	0.02
Terpinolene	5.62*	1085	0.21	4.40*	1243	[0.57]
trans-Linalool oxide (fur.)	5.62*	1085	[0.21]	7.02*	1429	[0.16]
trans-Sabinene hydrate	5.81*	1097	0.04	8.08	1508	0.04
Rosefuran	5.81*	1097	[0.04]	6.12	1364	0.02
Linalool	5.94	1106	33.47	8.23†	1520	65.63
(Z)-6-Methyl-3,5-heptadien-2-one	5.96	1107	0.04	8.32*†	1527	[65.63]
Octen-3-yl acetate	6.11	1116	0.74	5.92*	1349	[0.77]
Unknown [m/z 82, 81 (72), 43 (64), 54 (32), 41 (20)...]	6.15	1119	0.04	9.74*	1638	0.83
Octan-3-yl acetate	6.29	1128	0.08	5.36	1309	0.11
allo-Ocimene	6.32	1130	0.09	5.70	1334	0.08
(Z)-Myroxide	6.38*	1134	0.04	6.98	1426	0.02
trans-Pinocarveol	6.38*	1134	[0.04]	9.28*	1601	0.22
Camphor	6.43	1137	0.23	7.33	1452	0.23
(E)-Myroxide	6.51	1142	0.04	7.20	1443	0.02
Unknown [m/z 95, 43 (74), 109 (72), 82 (62), 110 (50)... 152 (14)]	6.56	1146	0.02	7.12	1437	0.01
Hexyl isobutyrate	6.66*	1152	0.08	5.44	1315	0.07
Nerol oxide	6.66*	1152	[0.08]	6.92	1422	0.02
Unknown [m/z 97, 81 (96), 109 (80), 43 (53), 53 (40), 41 (36), 56 (29), 95 (25)... 152 (1)]	6.69	1154	0.01	7.54	1468	0.01
Borneol	6.81	1162	0.67	9.90*	1651	1.97
Lavandulol	6.92	1169	0.80	9.74*	1638	[0.83]
(3E,5E)-Undeca-1,3,5-triene	7.02*	1175	3.42	6.05	1359	0.05
Terpinen-4-ol	7.02*	1175	[3.42]	8.71	1557	3.35
meta-Cymen-8-ol	7.10*	1180	0.22	11.61	1794	0.06
Cryptone	7.10*	1180	[0.22]	9.28*	1601	[0.22]
para-Cymen-8-ol	7.15	1184	0.06	11.64	1796	0.05
Myrtenal	7.22*	1189	0.94	8.80	1564	0.04
α-Terpineol	7.22*	1189	[0.94]	9.90*	1651	[1.97]

Hexyl butyrate	7.33	1196	0.35	6.42	1385	0.32
Unknown [m/z 43, 71 (66), 59 (52), 41 (47), 68 (46)...]	7.44	1203	0.03	6.21	1370	0.02
Octyl acetate	7.64	1216	0.02	7.22	1444	0.01
<i>trans</i> -Carveol	7.66	1218	0.03	11.51	1785	0.02
Bornyl formate	7.76	1224	0.03	8.11	1510	0.01
Nerol	7.85	1230	0.16	11.18	1757	0.16
Hexyl 2-methylbutyrate	7.92*	1235	0.09	6.60	1399	0.04
Cuminal	7.92*	1235	[0.09]	10.75	1721	0.05
Carvone	8.00*	1241	0.06	10.11	1668	0.04
Neral	8.00*	1241	[0.06]	9.59	1626	0.03
Hexyl isovalerate	8.00*	1241	[0.06]	6.86	1418	0.03
Geraniol	8.34*	1265	32.88	11.75	1805	0.40
Linalyl acetate	8.34*	1265	[32.88]	8.32*†	1527	[65.63]
<i>trans</i> -Ascaridole glycol	8.40	1269	0.05	14.34	2042	0.05
Geranial	8.45	1272	0.07	10.31*	1684	0.37
2,6-Dimethyl-1,7-octadiene-3,6-diol	8.59	1282	0.02	14.80	2087	0.02
Bornyl acetate	8.66	1287	0.10	8.41*	1534	0.47
Lavandulyl acetate	8.82	1298	2.42	8.91	1572	2.42
Hexyl tiglate	9.37	1330	0.05	9.03	1582	0.04
Hodiendiol derivative	9.50	1339	0.03	13.04	1921	0.05
Unknown [m/z 43, 79 (47), 71 (31), 94 (27), 81 (23), 41 (22)... 197 (0)]	9.65	1350	0.11			
Unknown [m/z 43, 79 (46), 71 (30), 94 (25), 41 (23), 81 (21)... 197 (0)]	9.70	1354	0.05	11.28	1766	0.02
Neryl acetate	9.85	1364	0.33	10.31*	1684	[0.37]
7-Cubebene	9.94	1371	0.02	7.30	1450	0.02
β-Bourbonene	10.05	1379	0.04	7.63	1474	0.04
Geranyl acetate	10.12	1384	0.56	10.68	1715	0.55
Hexyl hexanoate	10.17†	1387	0.14	9.01	1580	0.08
7-epi-Sesquithujene	10.19†	1388	[0.14]	8.00	1502	0.07
Isocaryophyllene	10.41	1404	0.04	8.32*†	1527	[65.63]
β-Caryophyllene	10.52*	1413	3.38	8.60*	1548	3.42
<i>cis</i> -α-Bergamotene	10.52*	1413	[3.38]	8.41*	1534	[0.47]
α-Santalene	10.57	1416	0.31	8.41*	1534	[0.47]
Coumarin	10.62	1420	0.05	17.21	2334	0.06
Lavandulyl isobutyrate	10.66	1423	0.02	9.49	1618	0.08
<i>trans</i> -α-Bergamotene	10.79	1433	0.11	8.60*	1548	[3.42]

Isogermacrene D	10.86	1439	0.01	9.16	1591	0.01
Sesquisabinene A	10.89	1441	0.03	9.35	1607	0.04
<i>cis</i> - β -Bergamotene?	10.91	1442	0.03			
α -Humulene	10.97	1447	0.09	9.42	1613	0.09
Lavandulyl butyrate?	11.08	1455	0.08	10.64	1711	0.11
β -Santalene	11.12*	1458	2.28	9.28*	1601	[0.22]
(<i>E</i>)- β -Farnesene	11.12*	1458	[2.28]	9.69	1634	2.31
Dauca-5,8-diene?	11.23	1466	0.02	9.28*	1601	[0.22]
Germacrene D	11.35	1475	0.37	9.90*	1651	[1.97]
<i>trans</i> - β -Bergamotene	11.43	1481	0.05	9.74*	1638	[0.83]
Isodaucene	11.56	1490	0.02	10.15	1671	0.02
β -Bisabolene	11.80*	1509	0.13	10.31*	1684	[0.37]
γ -Cadinene	11.80*	1509	[0.13]	10.53	1702	0.12
Lavandulyl isovalerate	11.82	1511	0.02	10.81	1726	0.03
Isocaryophyllene epoxide B	12.25	1545	0.02	12.26	1851	0.04
Caryophyllene oxide isomer	12.63*	1575	0.26	12.82	1900	0.03
Caryophyllene oxide	12.63*	1575	[0.26]	12.90	1907	0.25
Dendrolasin	12.63*	1575	[0.26]	12.67	1887	0.01
τ -Cadinol	13.38	1636	0.06	15.02	2108	0.09
(3 <i>Z</i>)-Caryophylla-3,8(13)-dien-5 β -ol	13.75	1666	0.01	16.98	2308	0.01
α -Bisabolol	13.93	1681	0.01	15.54	2160	tr
Total identified		98.62%			98.13%	
Total reported		98.87%			98.18%	

*: 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