Date : December 17, 2019

Certificate of Analysis – GC Profiling

Sample identification

Internal code : 19L05-PTH04-1-CC
Customer identification : Lavender Org - Bulgaria - L5011191R
Type : Essential oil
Source : *Lavandula angustifolia*
Customer : Plant Therapy

Analysis

Method: PC-MAT-007 - Analysis of the composition of an essential oil or other volatile liquide by FAST GC-FID (in French); identifications validated by GC-MS.
Analyst : Sylvain Mercier, M. Sc., Chimiste
Analysis date : December 11, 2019

Checked and approved by :

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

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PHYSICOCHEMICAL DATA

Physical aspect: Clear liquid
Refractive index: 1.4620 ± 0.0003 (20 °C)

ISO 3515:2004 - OIL OF CLONAL LAVENDER - BULGARIA

Compound	Min. %	Max. %	Observed %	Complies?
α-Terpineol	0.8	2.0	1.1	Yes
Lavandulyl acetate	2	5	3	Yes
Terpinen-4-ol	2	5	4	Yes
Lavandulol	0.3		1.1	Yes
Linalyl acetate	30	42	29	No
Linalool	22	34	30	Yes
Camphor		0.6	0.4	Yes
Octan-3-one	0.2	1.6	1.1	Yes
(E)-β-Ocimene	2	5	3	Yes
(Z)-β-Ocimene	3	9	5	Yes
β-Phellandrene		0.6	0.2	Yes
1,8-Cineole		2.0	0.9	Yes
Limonene		0.6	0.4	Yes
Refractive index	1.4590	1.4630	1.4620	Yes

CONCLUSION

No adulterant, contaminant or diluent has been detected using this method. The oil marginally does not comply with the ISO standard for Bulgarian lavender oil.

Analysis summary – Consolidated contents

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

Identification	%	Classe
Ethanol	tr	Aliphatic alcohol
Acetone	0.01	Aliphatic ketone
Isobutyral	0.01	Aliphatic aldehyde
3-Buten-2-one	tr	Aliphatic ketone
2-Methyl-3-buten-2-ol	0.02	Aliphatic alcohol
Isovaleral	0.03	Aliphatic aldehyde
2-Methylbutyral	0.01	Aliphatic aldehyde
Isoamyl alcohol	0.01	Aliphatic alcohol
2-Methylbutanol	0.01	Aliphatic alcohol
Toluene	0.01	Simple phenolic
Hexanal	tr	Aliphatic aldehyde
Butyl acetate	0.02	Aliphatic ester
Methyl hexyl ether	0.11	Aliphatic ether
(3*Z*)-Hexenol	0.02	Aliphatic alcohol
Hexanol	0.10	Aliphatic alcohol
Tricyclene	0.03	Monoterpene
α-Thujene	0.11	Monoterpene
α-Pinene	0.25	Monoterpene
α-Fenchene	tr	Monoterpene
Thujadiene isomer	0.01	Monoterpene
Camphene	0.19	Monoterpene
5,5-Dimethyl-2(5H)-furanone	0.01	Aliphatic lactone
Butyl isobutyrate	0.02	Aliphatic ester
Sabinene	0.05	Monoterpene
β-Pinene	0.06	Monoterpene
Octen-3-ol	0.23	Aliphatic alcohol
6-Methyl-5-hepten-2-one	0.01	Aliphatic ketone
Octan-3-one	1.10	Aliphatic ketone
Myrcene	0.67	Monoterpene
Octan-3-ol	0.22	Aliphatic alcohol
Butyl butyrate	0.11	Aliphatic ester
α-Phellandrene	0.04	Monoterpene
Pseudolimonene	0.01	Monoterpene
Δ3-Carene	0.14	Monoterpene
(3*Z*)-Hexenyl acetate	0.02	Aliphatic ester
α-Terpinene	0.06	Monoterpene
Hexyl acetate	0.59	Aliphatic ester
ortho-Cymene	0.05	Monoterpene
para-Cymene	0.22	Monoterpene
Limonene	0.35	Monoterpene
β-Phellandrene	0.22	Monoterpene
1,8-Cineole	0.90	Monoterpenic ether
(*Z*)-β-Ocimene	5.19	Monoterpene
(*E*)-β-Ocimene	2.65	Monoterpene
γ-Terpinene	0.16	Monoterpene
cis-Sabinene hydrate	0.06	Monoterpenic alcohol
cis-Linalool oxide (fur.)	0.16	Monoterpenic alcohol

Octanol	0.02	Aliphatic alcohol
Terpinolene	0.07	Monoterpene
trans-Linalool oxide (fur.)	0.11	Monoterpenic alcohol
α-Pinene oxide	0.01	Monoterpenic ether
trans-Sabinene hydrate	0.01	Monoterpenic alcohol
Rosefuran	0.06	Monoterpenic ether
Linalool	29.97	Monoterpenic alcohol
(*Z*)-6-Methyl-3,5-heptadien-2-one	0.07	Aliphatic ketone
β-Thujone	0.05	Monoterpenic ketone
Octen-3-yl acetate	0.74	Aliphatic ester
Unknown	0.04	Unknown
α-Campholenal	0.01	Monoterpenic aldehyde
Octan-3-yl acetate	0.12	Aliphatic ester
allo-Ocimene	0.05	Monoterpene
(*Z*)-Myroxide	0.04	Monoterpenic ether
Camphor	0.37	Monoterpenic ketone
(*E*)-Myroxide	0.04	Monoterpenic ether
trans-Verbenol	0.01	Monoterpenic alcohol
Nerol oxide	0.02	Aliphatic ether
Hexyl isobutyrate	0.08	Aliphatic ester
Unknown	0.03	Oxygenated monoterpene
Borneol	0.68	Monoterpenic alcohol
cis-Linalool oxide (pyr.)	0.02	Monoterpenic alcohol
Lavandulol	1.12	Monoterpenic alcohol
Terpinen-4-ol	4.17	Monoterpenic alcohol
(3*E*,5*Z*)-Undeca-1,3,5-triene	0.09	Alkene
Cryptone	0.22	Normonoterpenic ketone
meta-Cymen-8-ol	0.03	Monoterpenic alcohol
para-Cymen-8-ol	0.09	Monoterpenic alcohol
α-Terpineol	1.06	Monoterpenic alcohol
Hexyl butyrate	0.39	Aliphatic ester
Hodiendiol	tr	Monoterpenic alcohol
Verbenone	0.03	Monoterpenic ketone
Unknown	0.04	Unknown
trans-Carveol	0.05	Monoterpenic alcohol
Bornyl formate	0.05	Monoterpenic ester
cis-Carveol	tr	Monoterpenic alcohol
Nerol	0.18	Monoterpenic alcohol
Hexyl 2-methylbutyrate	0.08	Aliphatic ester
Cuminal	0.01	Monoterpenic aldehyde
Carvone	0.04	Monoterpenic ketone
Neral	0.06	Monoterpenic aldehyde
Linalyl acetate	28.71	Monoterpenic ester
Geraniol	0.44	Monoterpenic alcohol
Geranial	0.05	Monoterpenic aldehyde
Bornyl acetate	0.18	Monoterpenic ester
Lavandulyl acetate	3.42	Monoterpenic ester
Hexyl tiglate	0.07	Aliphatic ester
Hodiendiol derivative	0.02	Oxygenated monoterpene
Unknown	0.03	Oxygenated monoterpene
Unknown	0.03	Oxygenated monoterpene
Neryl acetate	0.31	Monoterpenic ester

α-Copaene	0.02	Sesquiterpene
Daucene	0.01	Sesquiterpene
β-Bourbonene	0.04	Sesquiterpene
Geranyl acetate	0.50	Monoterpenic ester
7-epi-Sesquithujene	0.09	Sesquiterpene
Hexyl hexanoate	0.10	Aliphatic ester
Isocaryophyllene	0.02	Sesquiterpene
β-Caryophyllene	3.53	Sesquiterpene
cis-α-Bergamotene	0.02	Sesquiterpene
α-Santalene	0.45	Sesquiterpene
Coumarin	0.06	Coumarin
trans-α-Bergamotene	0.15	Sesquiterpene
cis-β-Bergamotene?	0.05	Sesquiterpene
Sesquisabinene A	0.02	Sesquiterpene
α-Humulene	0.12	Sesquiterpene
Lavandulyl butyrate?	0.12	Monoterpenic ester
(*E*)-β-Farnesene	3.88	Sesquiterpene
β-Santalene	0.02	Sesquiterpene
trans-Cadina-1(6),4-diene	0.03	Sesquiterpene
Germacrene D	0.41	Sesquiterpene
trans-β-Bergamotene	0.07	Sesquiterpene
Isodaucene	0.02	Sesquiterpene
Lavandulyl isovalerate	0.04	Monoterpenic ester
γ-Cadinene	0.13	Sesquiterpene
δ-Cadinene	0.02	Sesquiterpene
Isocaryophyllene epoxide B	0.08	Sesquiterpenic ether
(*E*)-Nerolidol	0.02	Sesquiterpenic alcohol
Caryophyllene oxide	0.29	Sesquiterpenic ether
Caryophyllene oxide isomer	0.04	Sesquiterpenic ether
Dendrolasin	0.03	Sesquiterpenic ether
Humulene epoxide II	0.01	Sesquiterpenic ether
τ-Cadinol	0.07	Sesquiterpenic alcohol
(3*Z*)-Caryophylla-3,8(13)-dien-5β-ol	0.02	Sesquiterpenic alcohol
Consolidated total	**98.33%**	

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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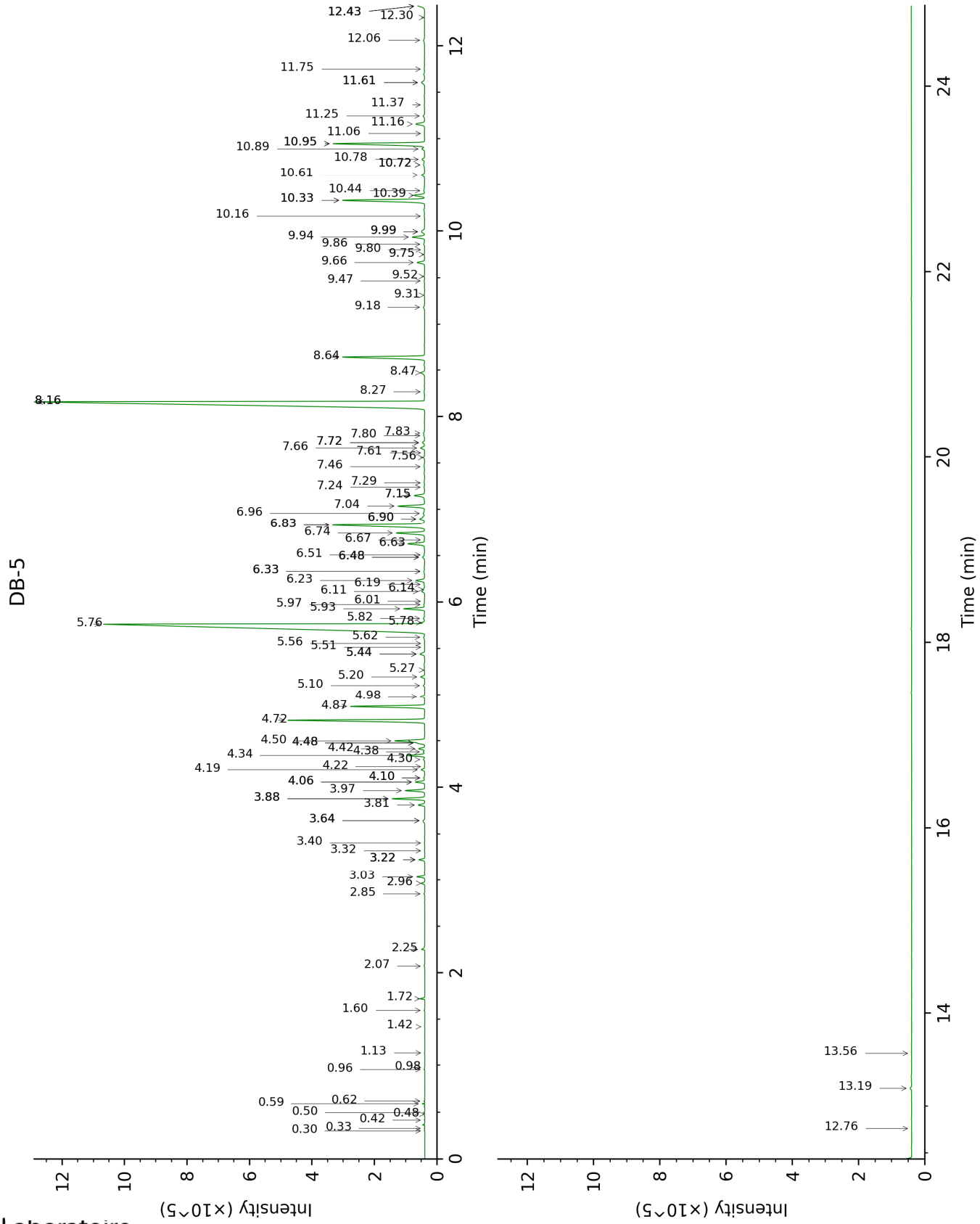
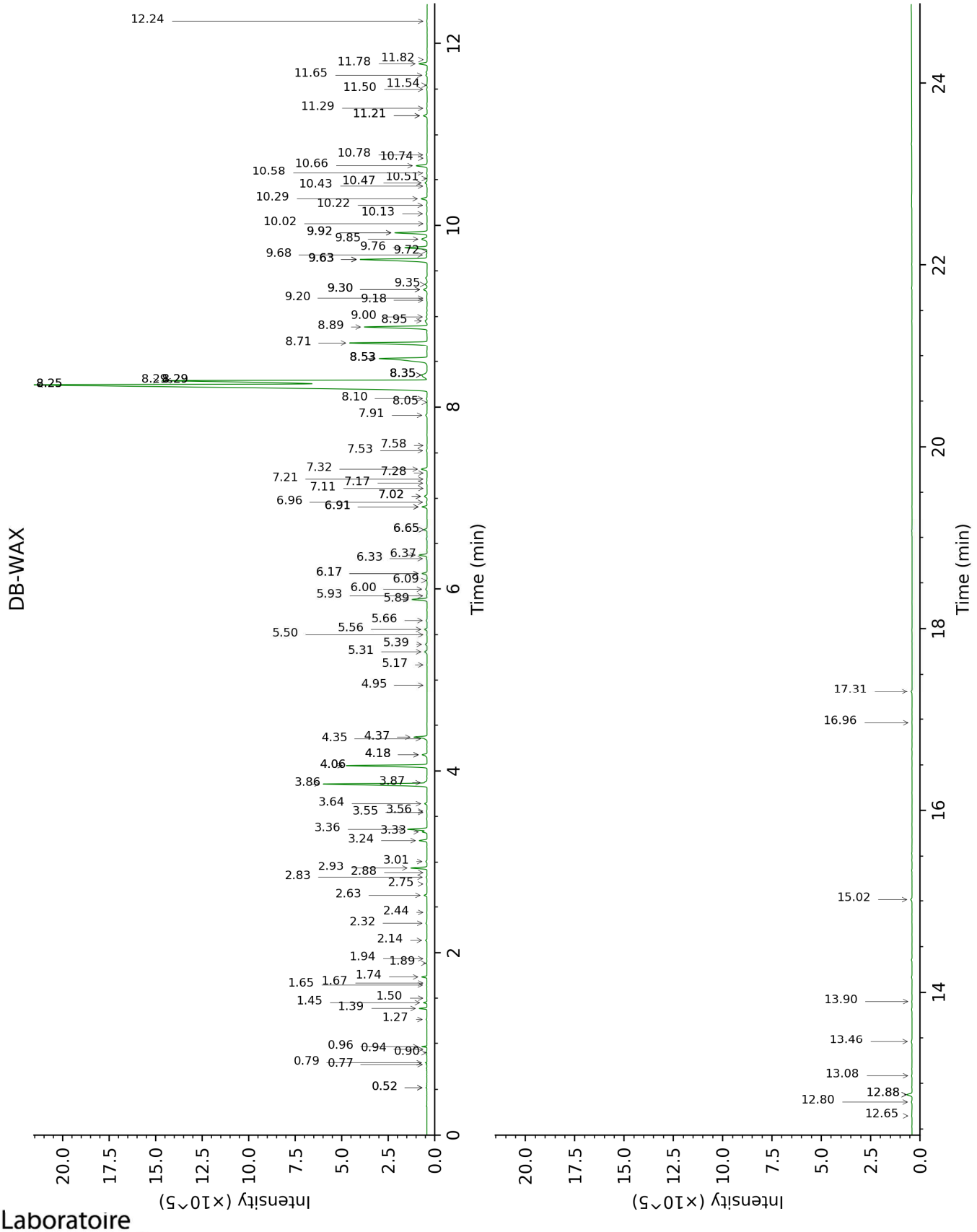

DB-5
Time (min)
Intensity (×10^5)
12.43
12.30
12.06
11.75
11.61
11.37
11.25
11.16
11.06
10.89
10.95
10.78
10.72
10.61
10.44
10.39
10.33
10.16
9.94
9.99
9.86
9.80
9.75
9.66
9.47
9.52
9.31
9.18
8.64
8.47
8.27
8.16
7.66
7.72
7.80
7.83
7.61
7.56
7.46
7.24
7.29
7.15
7.04
6.96
6.90
6.83
6.74
6.67
6.63
6.51
6.48
6.33
6.23
6.19
6.11
6.14
5.97
5.93
6.01
5.82
5.78
5.76
5.62
5.56
5.51
5.44
5.27
5.20
5.10
4.98
4.87
4.72
4.50
4.48
4.42
4.38
4.34
4.30
4.22
4.19
4.10
4.06
3.97
3.88
3.81
3.64
3.40
3.32
3.22
3.03
2.96
2.85
2.25
2.07
1.72
1.60
1.42
1.13
0.98
0.96
0.62
0.59
0.50
0.48
0.42
0.33
0.30
13.56
13.19
12.76


DB-WAX
Time (min)
Intensity (×10^5)
12.24
11.78
11.82
11.65
11.50
11.54
11.29
11.21
10.78
10.74
10.66
10.58
10.43
10.47
10.51
10.29
10.22
10.13
10.02
9.92
9.85
9.76
9.72
9.68
9.63
9.35
9.30
9.20
9.18
9.00
8.95
8.89
8.71
8.53
8.35
8.25
8.10
8.05
7.91
7.58
7.53
7.32
7.28
7.21
7.17
7.11
7.02
6.96
6.91
6.65
6.37
6.33
6.17
6.09
6.00
5.93
5.89
5.66
5.56
5.50
5.39
5.31
5.17
4.95
4.37
4.35
4.18
4.06
3.87
3.86
3.64
3.56
3.55
3.36
3.33
3.24
3.01
2.93
2.88
2.83
2.75
2.63
2.44
2.32
2.14
1.94
1.89
1.74
1.67
1.65
1.50
1.45
1.39
1.27
0.96
0.94
0.90
0.79
0.77
0.52
17.31
16.96
15.02
13.90
13.46
13.08
12.88
12.80
12.65

FULL ANALYSIS DATA

Identification	Column DB-5			Column DB-WAX		
	R.T	R.I	%	R.T	R.I	%
Ethanol	0.30	522	tr	0.90	909	0.01
Acetone	0.33	522	0.01	0.52*	784	0.03
Isobutyral	0.42	533	0.01	0.52*	784	[0.03]
3-Buten-2-one	0.48	578	tr	0.94	915	tr
2-Methyl-3-buten-2-ol	0.50	590	0.02	1.65	1017	0.02
Isovaleral	0.59	640	0.03	0.79	890	0.03
2-Methylbutyral	0.62	651	0.01	0.77	882	0.01
Isoamyl alcohol	0.96	736	0.01	3.56	1183	0.02
2-Methylbutanol	0.98	739	0.01	3.55	1182	0.01
Toluene	1.13	761	0.01	1.50	1002	0.01
Hexanal	1.42	801	tr	1.94	1045	tr
Butyl acetate	1.60	817	0.02	1.89	1040	0.02
Methyl hexyl ether	1.72	827	0.11	0.96	920	0.12
(3*Z*)-Hexenol	2.07	856	0.02	5.93	1353	0.03
Hexanol	2.25	871	0.10	5.56	1327	0.11
Tricyclene	2.85	917	0.03	1.27	970	0.03
α-Thujene	2.96	924	0.11	1.45	998	0.11
α-Pinene	3.03	929	0.25	1.39	990	0.26
α-Fenchene	3.22*	941	0.20	1.67	1019	tr
Thujadiene isomer	3.22*	941	[0.20]	2.44	1095	0.01
Camphene	3.22*	941	[0.20]	1.74	1026	0.19
5,5-Dimethyl-2(5H)-furanone	3.32	948	0.01	8.53*	1547	3.69
Butyl isobutyrate	3.40	953	0.02	2.75	1120	0.01
Sabinene	3.64*	969	0.10	2.32	1084	0.05
β-Pinene	3.64*	969	[0.10]	2.14	1065	0.06
Octen-3-ol	3.81	980	0.23	6.91*	1425	0.25
6-Methyl-5-hepten-2-one	3.88*	985	1.11	5.17	1299	0.01
Octan-3-one	3.88*	985	[1.11]	4.06*	1220	3.78
Myrcene	3.97	991	0.67	2.93	1133	0.67
Octan-3-ol	4.06*	997	0.33	6.17*	1371	0.26
Butyl butyrate	4.06*	997	[0.33]	3.64	1189	0.11
α-Phellandrene	4.10*	1000	0.05	2.83	1125	0.04
Pseudolimonene	4.10*	1000	[0.05]	2.88	1129	0.01
Δ3-Carene	4.19	1006	0.14	2.63	1110	0.13
(3*Z*)-Hexenyl acetate	4.22	1008	0.02	4.95	1284	0.01
α-Terpinene	4.30	1012	0.06	3.01	1140	0.05
Hexyl acetate	4.34	1015	0.59	4.37	1242	0.62
ortho-Cymene	4.38	1018	0.05	4.18*	1228	0.27
para-Cymene	4.42	1020	0.22	4.18*	1228	[0.27]
Limonene	4.48*†	1024	1.48	3.24	1157	0.35
β-Phellandrene	4.48*†	1024	[1.48]	3.33	1165	0.22
1,8-Cineole	4.50†	1025	[1.48]	3.36	1167	0.90

(*Z*)-β-Ocimene	4.72	1039	5.19	3.86†	1205	5.43
(*E*)-β-Ocimene	4.87	1049	2.65	4.06*	1220	[3.78]
γ-Terpinene	4.98	1056	0.16	3.87†	1206	[5.43]
cis-Sabinene hydrate	5.10	1064	0.06	7.02*	1433	0.16
cis-Linalool oxide (fur.)	5.20	1070	0.16	6.65*	1406	0.15
Octanol	5.27	1074	0.02	8.29*†	1528	[58.79]
Terpinolene	5.44*	1085	0.23	4.35	1241	0.07
trans-Linalool oxide (fur.)	5.44*	1085	[0.23]	7.02*	1433	[0.16]
α-Pinene oxide	5.51	1090	0.01	5.50	1322	0.01
trans-Sabinene hydrate	5.56	1093	0.01	8.06	1510	0.01
Rosefuran	5.62	1097	0.06	6.09	1365	0.03
Linalool	5.76	1106	29.97	8.25*†	1525	58.79
(*Z*)-6-Methyl-3,5-heptadien-2-one	5.78	1107	0.07	8.29*†	1528	[58.79]
β-Thujone	5.82	1110	0.05	6.33	1382	0.05
Octen-3-yl acetate	5.93	1117	0.74	5.89	1350	0.73
Unknown [m/z 82, 81 (72), 43 (64), 54 (32), 41 (20)...]	5.97	1120	0.04	9.68	1637	0.05
α-Campholenal	6.01	1122	0.01	7.11	1440	0.01
Octan-3-yl acetate	6.11	1129	0.12	5.31	1309	0.14
allo-Ocimene	6.14	1131	0.05	5.66	1334	0.04
(*Z*)-Myroxide	6.19	1134	0.04	6.96	1428	0.05
Camphor	6.23	1137	0.37	7.32	1455	0.31
(*E*)-Myroxide	6.33*	1144	0.05	7.17	1444	0.04
trans-Verbenol	6.33*	1144	[0.05]	9.63*	1633	4.01
Nerol oxide	6.48*	1154	0.10	6.91*	1425	[0.25]
Hexyl isobutyrate	6.48*	1154	[0.10]	5.40	1315	0.08
Unknown [m/z 97, 81 (96), 109 (80), 43 (53), 53 (40), 41 (36), 56 (29), 95 (25)... 152 (1)]	6.51	1155	0.03	7.58	1474	0.01
Borneol	6.63	1163	0.68	9.92*	1657	1.71
cis-Linalool oxide (pyr.)	6.67	1166	0.02	10.43	1698	0.03
Lavandulol	6.74	1171	1.12	9.76	1643	1.13
Terpinen-4-ol	6.83*	1177	4.27	8.71	1561	4.17
(3*E*,5*Z*)-Undeca-1,3,5-triene	6.83*	1177	[4.27]	6.00	1358	0.09
Cryptone	6.90*	1181	0.27	9.30*	1606	0.24
meta-Cymen-8-ol	6.90*	1181	[0.27]	11.54	1792	0.03

para-Cymen-8-ol	6.96	1185	0.09	11.65	1801	0.07
α-Terpineol	7.04	1191	1.06	9.92*	1657	[1.71]
Hexyl butyrate	7.15*	1198	0.47	6.37	1385	0.39
Hodiendiol	7.15*	1198	[0.47]	12.88*	1909	0.29
Verbenone	7.24	1204	0.03	9.72	1640	0.02
Unknown [m/z 43, 71 (66), 59 (52), 41 (47), 68 (46)...]	7.29	1207	0.04	6.17*	1371	[0.26]
trans-Carveol	7.46	1220	0.05	11.50	1788	0.04
Bornyl formate	7.56	1227	0.05	8.10	1513	0.04
cis-Carveol	7.61	1230	tr	11.82	1816	0.01
Nerol	7.66	1234	0.18	11.21*	1764	0.22
Hexyl 2-methylbutyrate	7.72*	1234	0.10	6.65*	1406	[0.15]
Cuminal	7.72*	1234	[0.10]	10.74	1724	0.01
Carvone	7.80	1239	0.04	10.13	1673	0.06
Neral	7.82	1241	0.06	9.63*	1633	[4.01]
Linalyl acetate	8.16*	1263	29.37	8.29*†	1528	[58.79]
Geraniol	8.16*	1263	[29.37]	11.78	1812	0.44
Geranial	8.27	1270	0.05	10.22	1681	0.05
Bornyl acetate	8.47	1284	0.18	8.35*	1533	0.65
Lavandulyl acetate	8.64	1295	3.42	8.89	1574	3.44
Hexyl tiglate	9.18	1333	0.07	9.00	1583	0.05
Hodiendiol derivative	9.31	1342	0.02	13.08	1928	0.03
Unknown [m/z 43, 79 (47), 71 (31), 94 (27), 81 (23), 41 (22)... 197 (0)]	9.47	1352	0.03	11.21*	1764	[0.22]
Unknown [m/z 43, 79 (46), 71 (30), 94 (25), 41 (23), 81 (21)... 197 (0)]	9.52	1356	0.03	11.29	1770	0.03
Neryl acetate	9.66	1366	0.31	10.29	1686	0.33
α-Copaene	9.75	1372	0.02	7.21	1447	0.02
Daucene	9.80	1376	0.01	7.28	1452	tr
β-Bourbonene	9.86	1380	0.04	7.52	1470	0.05
Geranyl acetate	9.94	1386	0.50	10.66	1718	0.60
7-epi-Sesquithujene	10.00*	1390	0.21	7.91	1499	0.09
Hexyl hexanoate	10.00*	1390	[0.21]	8.95	1579	0.10
Isocaryophyllene	10.16	1401	0.02	8.25*†	1525	[58.79]
β-Caryophyllene	10.33*	1414	3.63	8.53*	1547	[3.69]
cis-α-Bergamotene	10.33*	1414	[3.63]	8.35*	1533	[0.65]
α-Santalene	10.39	1418	0.45	8.35*	1533	[0.65]
Coumarin	10.44	1421	0.06	17.31	2346	0.07
trans-α-	10.61	1434	0.15	8.53*	1547	[3.69]

Bergamotene						
cis-β-Bergamotene?	10.72*	1442	0.07			
Sesquisabinene A	10.72*	1442	[0.07]	9.18	1597	0.02
α-Humulene	10.78	1447	0.12	9.35	1611	0.11
Lavandulyl butyrate?	10.89	1455	0.12	10.58	1710	0.04
(*E*)-β-Farnesene	10.95*	1459	3.97	9.63*	1633	[4.01]
β-Santalene	10.95*	1459	[3.97]	9.20	1599	0.02
trans-Cadina-1(6),4-diene	11.06	1468	0.03	9.30*	1606	[0.24]
Germacrene D	11.16	1475	0.41	9.85	1651	0.40
trans-β-Bergamotene	11.25	1481	0.07	9.63*	1633	[4.01]
Isodaucene	11.37	1490	0.02	10.02	1664	0.02
Lavandulyl isovalerate	11.61*	1508	0.19	10.78	1728	0.04
γ-Cadinene	11.61*	1508	[0.19]	10.47	1701	0.13
δ-Cadinene	11.75	1520	0.02	10.51	1705	0.02
Isocaryophyllene epoxide B	12.06	1544	0.08	12.24	1853	0.04
(*E*)-Nerolidol	12.30	1563	0.02	13.90	2004	0.02
Caryophyllene oxide	12.43*	1573	0.36	12.88*	1909	[0.29]
Caryophyllene oxide isomer	12.43*	1573	[0.36]	12.80	1902	0.04
Dendrolasin	12.43*	1573	[0.36]	12.65	1888	0.03
Humulene epoxide II	12.76	1599	0.01	13.46	1962	0.06
τ-Cadinol	13.19	1634	0.07	15.02	2111	0.09
(3*Z*)-Caryophylla-3,8(13)-dien-5β-ol	13.56	1665	0.02	16.96	2309	0.01
Total identified		**98.75%**			**98.21%**	
Total reported		**98.91%**			**98.30%**	

*: 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