Date : May 24, 2019

Certificate of Analysis – GC Profiling

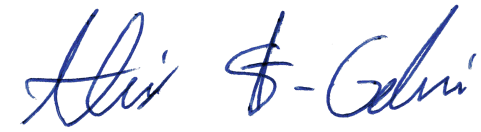
Sample identification

Internal code : 19E14-PTH02-1-SCC
Customer identification : Magnolia Flower - China - MQ0101812R
Type : Essential oil
Source : *Michelia x alba*
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 : May 21, 2019

Checked and approved by :



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

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PHYSICOCHEMICAL DATA

Physical aspect: Dark yellow liquid
Refractive index: 1.4680 ± 0.0003 (20 °C)

ISO 17382:2007 - OIL OF MAGNOLIA FLOWER, CHINA TYPE

Compound	Min. %	Max. %	Observed %	Complies?
Methyl (E)-isoeugenol	0.3	1.8	0.3	Yes
(E)-Nerolidol	0.2	0.6	0.4	Yes
Methyleugenol	1.2	4.4	2.8	Yes
Nerol	0.001	0.300	0.087	Yes
δ-Cadinene	0.3	2.5	0.7	Yes
β-Caryophyllene	1.2	7.0	5.0	Yes
β-Elemene	2.1	10.0	2.6	Yes
Linalool	50.0	72.0	66.0	Yes
α-Copaene	0.1	0.8	0.4	Yes
(Z)-β-Ocimene	0.9	2.4	2.2	Yes
(E)-β-Ocimene	1.1	3.4	2.7	Yes
1,8-Cineole	0.3	0.8	0.5	Yes
Methyl 2-methylbutyrate	0.7	6.3	2.7	Yes
Refractive index	1.4650	1.4900	1.4680	Yes

CONCLUSION

No adulterant, contaminant or diluent has been detected using this method. The oil complies with the ISO standard for magnolia flower oil.

ANALYSIS SUMMARY

Identification	DB-5 (%)	DB-WAX (%)	Classe
Ethanol	0.03	0.03	Aliphatic alcohol
3-Buten-2-one	tr	tr	Aliphatic ketone
Methyl propionate	0.02	0.02	Aliphatic ester
1,3-Cyclohexadiene	tr		Alkene
Isovaleral	0.01	0.01	Aliphatic aldehyde
2-Methylbutyral	0.03	0.02	Aliphatic aldehyde
Methyl isobutyrate	tr	tr	Aliphatic ester
2-Methylbutanenitrile	tr		Aliphatic nitrile
Methyl butyrate	0.05	0.05	Aliphatic ester
Isoamyl alcohol	0.02	0.01	Aliphatic alcohol
2-Methylbutanol	0.02	0.02	Aliphatic alcohol
Methyl 2-methylbutyrate	2.68	2.63	Aliphatic ester
Ethyl 2-methylbutyrate	0.10	0.10	Aliphatic ester
(3*Z*)-Hexenol	0.01	0.01	Aliphatic alcohol
Hexanol	0.25*	0.02	Aliphatic alcohol
Isovaleric acid	[0.25]*	0.19*	Aliphatic acid
2-Methylbutyric acid	0.30*	1.42*	Aliphatic acid
2-Heptanone	[0.30]*	tr	Aliphatic ketone
Methyl hexanoate	0.02*	0.01	Aliphatic ester
α-Thujene	[0.02]*	0.01	Monoterpene
α-Pinene	0.15	0.14	Monoterpene
Camphene	0.05	0.04	Monoterpene
β-Pinene	0.32*	0.27	Monoterpene
Sabinene	[0.32]*	0.03	Monoterpene
Myrcene	0.11	0.10	Monoterpene
α-Phellandrene	0.04*	0.04	Monoterpene
cis-Dehydroxylinalool oxide	[0.04]*	[2.13]	Monoterpenic ether
Caproic acid	0.03		Aliphatic acid
α-Terpinene	0.02	0.01	Monoterpene
para-Cymene	0.02	0.02	Monoterpene
1,8-Cineole	0.78*	0.46	Monoterpenic ether
Limonene	[0.78]*	0.29	Monoterpene
(*Z*)-β-Ocimene	2.18	2.13*	Monoterpene
(*E*)-β-Ocimene	2.71	2.62	Monoterpene
γ-Terpinene	0.03	[2.13]*	Monoterpene
cis-Sabinene hydrate	0.01	0.25*	Monoterpenic alcohol
cis-Linalool oxide (fur.)	0.20	0.20	Monoterpenic alcohol
trans-Linalool oxide (fur.)	0.27*	[0.25]*	Monoterpenic alcohol
Terpinolene	[0.27]*	0.04	Monoterpene
Methyl benzoate	0.02	0.02	Phenolic ester
Rosefuran	0.01	0.02	Monoterpenic ether
Hotrienol	66.17*	0.07	Monoterpenic alcohol
Linalool	[66.17]*	66.00	Monoterpenic alcohol
endo-Fenchol	[66.17]*	0.04	Monoterpenic alcohol
Phenylethyl alcohol	0.38	0.41*	Simple phenolic
Methyl octanoate	0.01	0.01	Aliphatic ester
allo-Ocimene	0.07	0.06	Monoterpene
Linalyl methyl ether?	0.02		Monoterpenic ether

neo-allo-Ocimene	0.02*	tr	Monoterpene
Camphor	[0.02]*	0.02	Monoterpenic ketone
Camphene hydrate	0.02	7.58*	Monoterpenic alcohol
Nerol oxide	0.01	0.02	Aliphatic ether
Borneol	0.06	[1.42]*	Monoterpenic alcohol
Terpinen-4-ol	0.06	0.04	Monoterpenic alcohol
α-Terpineol	0.46	[1.42]*	Monoterpenic alcohol
Methylchavicol	0.06	0.05	Phenylpropanoid
(3*E*,5*E*)-2,6-Dimethylocta-3,5,7-trien-2-ol	0.03	0.04	Monoterpenic alcohol
Nerol	0.09	0.11	Monoterpenic alcohol
Geraniol	0.31*	0.36	Monoterpenic alcohol
trans-Linalool oxide acetate (pyr.)	[0.31]*	0.05	Monoterpenic ester
Undec-(5*Z*)-en-2-one	0.02	0.02	Aliphatic ketone
Safrole	0.03	[0.36]	Phenylpropanoid
Indole	0.05	0.05	Indole
1-Nitro-2-phenylethane	0.01	0.02	Simple phenolic
δ-Elemene	0.03	0.03	Sesquiterpene
α-Cubebene	0.10	0.09	Sesquiterpene
α-Copaene	0.35	0.35	Sesquiterpene
cis-β-Elemene	0.10	0.08	Sesquiterpene
β-Cubebene	0.08	0.09	Sesquiterpene
β-Elemene	2.59	[7.58]*	Sesquiterpene
Methyleugenol	2.79	2.79	Phenylpropanoid
cis-α-Bergamotene	5.07*	0.10	Sesquiterpene
β-Caryophyllene	[5.07]*	[7.58]*	Sesquiterpene
β-Copaene	0.14	0.10	Sesquiterpene
trans-α-Bergamotene	0.16	[7.58]*	Sesquiterpene
Phenylethyl butyrate?	0.02		Phenolic ester
α-Humulene	0.83	0.79	Sesquiterpene
allo-Aromadendrene	0.01	0.01	Sesquiterpene
(*E*)-β-Farnesene	0.05	0.03	Sesquiterpene
Selina-4,11-diene	0.17	0.13	Sesquiterpene
γ-Muurolene	0.08	[0.19]*	Sesquiterpene
Germacrene D	0.71	[1.42]*	Sesquiterpene
β-Selinene	0.73	0.76	Sesquiterpene
Phenylethyl isovalerate	0.14		Phenolic ester
α-Selinene	0.65	0.72	Sesquiterpene
Methyl (*E*)-isoeugenol	0.29	0.26	Phenylpropanoid
Germacrene A	0.76*	0.72*	Sesquiterpene
α-Muurolene	[0.76]*	0.17	Sesquiterpene
β-Bisabolene	0.42	0.24	Sesquiterpene
γ-Cadinene	[0.42]*	[0.72]*	Sesquiterpene
Cubebol	[0.42]*	0.03	Sesquiterpenic alcohol
(3*E*,6*E*)-α-Farnesene	[0.42]*	0.16	Sesquiterpene
Unknown	0.02		Sesquiterpene
δ-Cadinene	0.85*	0.75	Sesquiterpene
Zonarene	[0.85]*	[0.72]*	Sesquiterpene
trans-Cadina-1,4-diene	0.06	0.06	Sesquiterpene
α-Cadinene	0.01	0.01	Sesquiterpene
α-Calacorene	0.04	[0.41]*	Sesquiterpene
Isocaryophyllene epoxide B	0.04	[0.41]*	Sesquiterpenic ether

α-Elemol	0.03	0.04	Sesquiterpenic alcohol
Elemicin	0.02	0.02	Phenylpropanoid
(*E*)-Nerolidol	0.40	0.46*	Sesquiterpenic alcohol
Caryophyllene oxide isomer	0.43*	0.02	Sesquiterpenic ether
Caryophyllene oxide	[0.43]*	0.45	Sesquiterpenic ether
Humulene epoxide II	0.10	0.06	Sesquiterpenic ether
Unknown	0.08*	0.07	Oxygenated sesquiterpene
Junenol	[0.08]*	0.02	Sesquiterpenic alcohol
1-epi-Cubenol	0.08	[0.46]*	Sesquiterpenic alcohol
τ-Cadinol	0.40*	0.18	Sesquiterpenic alcohol
τ-Muurolol	[0.40]*	0.18	Sesquiterpenic alcohol
α-Muurolol	0.05	0.05	Sesquiterpenic alcohol
Selin-11-en-4α-ol	0.21	0.19*	Sesquiterpenic alcohol
α-Cadinol	0.07	0.07	Sesquiterpenic alcohol
(3*Z*)-Caryophylla-3,8(13)-dien-5β-ol	0.12	0.13	Sesquiterpenic alcohol
Unknown	0.02	0.02	Aliphatic ester
Unknown	0.10	0.10	Aliphatic ester
Nonadecane	0.02	0.04	Alkane
Methyl palmitate	0.02	[0.19]*	Aliphatic ester
Methyl linoleate	0.14	0.15	Aliphatic ester
Methyl α-linolenate	0.08	0.08	Aliphatic ester
Total identified	**97.91%**	**96.81%**	

*: 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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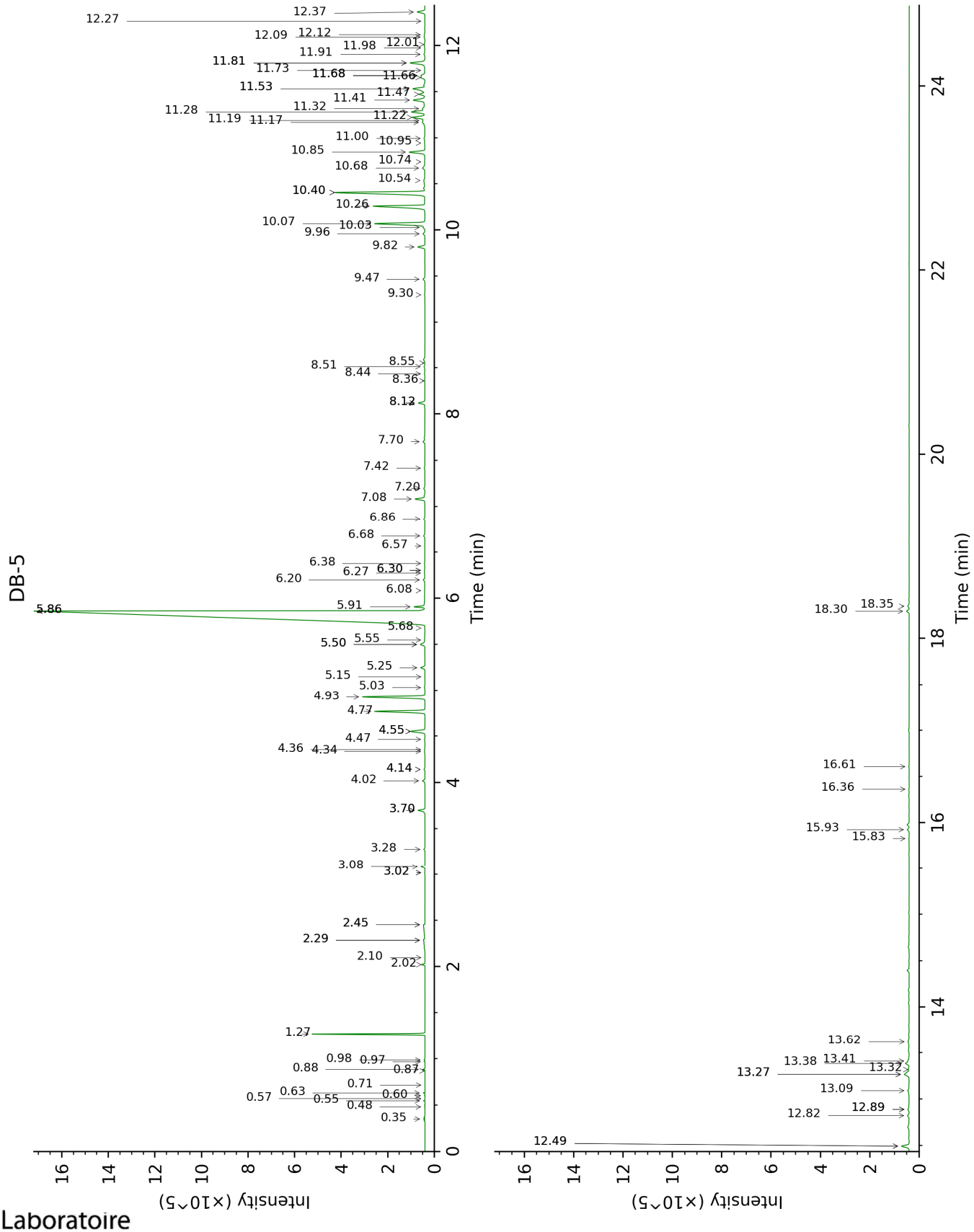
DB-5
Time (min)
Intensity (×10^5)
12.27
12.37
12.09
12.12
11.98
12.01
11.91
11.81
11.73
11.68
11.66
11.53
11.47
11.41
11.28
11.32
11.19
11.17
11.22
11.00
10.95
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10.07
10.03
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9.82
9.47
9.30
8.51
8.55
8.44
8.36
8.12
7.70
7.42
7.20
7.08
6.86
6.68
6.57
6.38
6.27
6.30
6.20
6.08
5.91
5.86
5.68
5.50
5.55
5.25
5.15
5.03
4.93
4.77
4.55
4.47
4.36
4.34
4.14
4.02
3.70
3.28
3.08
3.02
2.45
2.29
2.10
2.02
1.27
0.98
0.97
0.88
0.87
0.71
0.63
0.57
0.60
0.55
0.48
0.35
18.30
18.35
16.61
16.36
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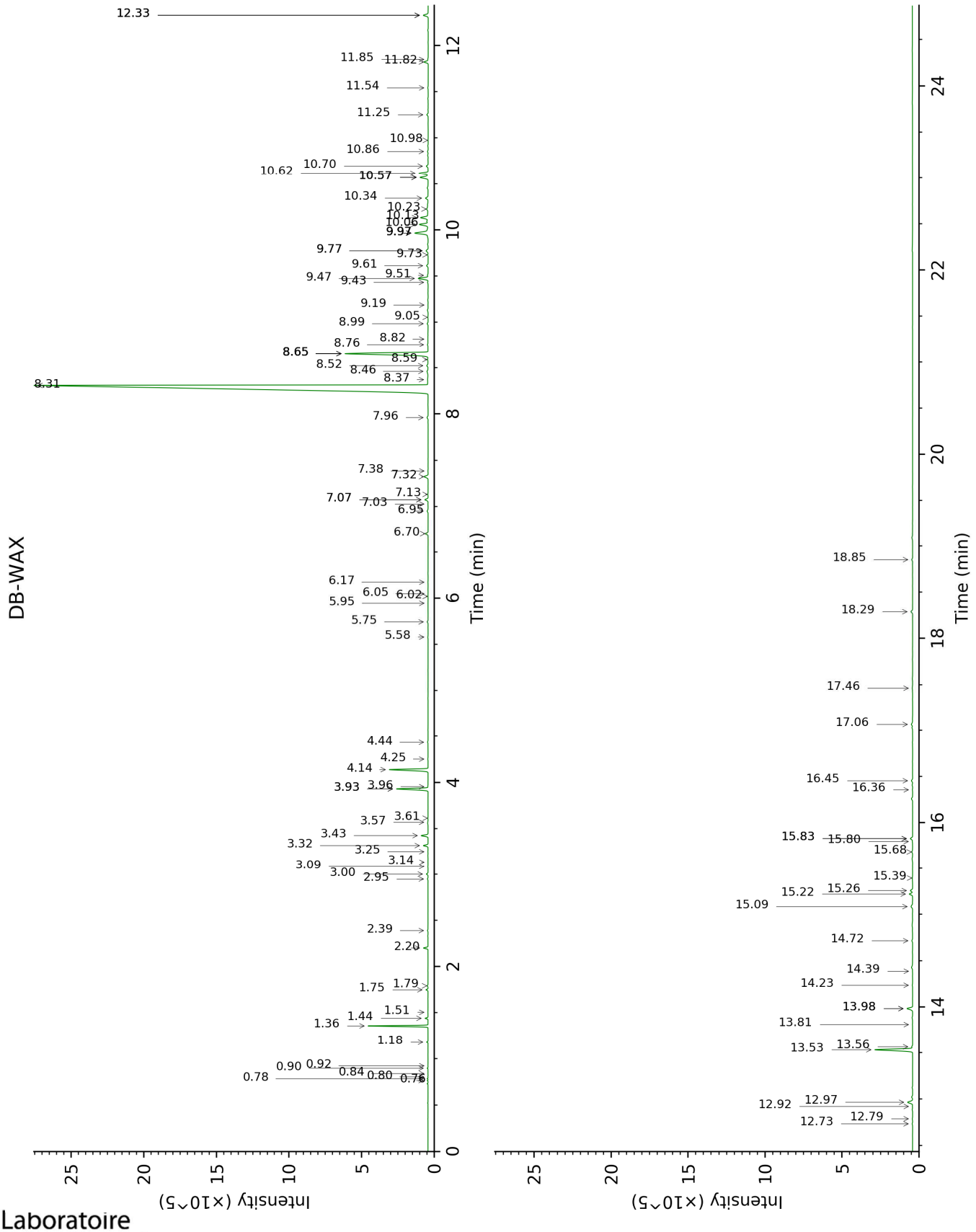
15.83
13.62
13.38
13.41
13.32
13.27
13.09
12.89
12.82
12.49


DB-WAX
Time (min)
Intensity (×10^5)
12.33
11.85
11.82
11.54
11.25
10.98
10.86
10.70
10.62
10.57
10.34
10.23
10.13
10.06
9.97
9.77
9.73
9.61
9.51
9.47
9.43
9.19
9.05
8.99
8.82
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8.59
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8.37
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7.13
7.07
7.03
6.95
6.70
6.17
6.05
6.02
5.95
5.75
5.58
4.44
4.25
4.14
3.96
3.93
3.61
3.57
3.43
3.32
3.25
3.14
3.09
3.00
2.95
2.39
2.20
1.79
1.75
1.51
1.44
1.36
1.18
0.92
0.90
0.84
0.80
0.78
18.85
18.29
17.46
17.06
16.45
16.36
15.83
15.80
15.68
15.39
15.26
15.22
15.09
14.72
14.39
14.23
13.98
13.81
13.56
13.53
12.97
12.92
12.79
12.73

FULL ANALYSIS DATA

Identification	Column DB-5			Column DB-WAX		
	R.T	R.I	%	R.T	R.I	%
Ethanol	0.35	518	0.03	0.90	906	0.03
3-Buten-2-one	0.48	576	tr	0.92	910	tr
Methyl propionate	0.55	620	0.02	0.76	873	0.02
1,3-Cyclohexadiene	0.57	629	tr			
Isovaleral	0.60	641	0.01	0.80	887	0.01
2-Methylbutyral	0.63	652	0.03	0.78	880	0.02
Methyl isobutyrate	0.72	684	tr	0.84	897	tr
2-Methylbutanenitrile	0.87	721	tr			
Methyl butyrate	0.88	723	0.05	1.18	950	0.05
Isoamyl alcohol	0.97	734	0.02	3.61	1179	0.01
2-Methylbutanol	0.98	737	0.02	3.57	1176	0.02
Methyl 2-methylbutyrate	1.27	776	2.68	1.36	978	2.63
Ethyl 2-methylbutyrate	2.02	849	0.10	1.75	1022	0.10
(3*Z*)-Hexenol	2.10	856	0.01	5.95	1346	0.01
Hexanol	2.29*	871	0.25	5.58	1320	0.02
Isovaleric acid	2.29*	871	[0.25]	9.77*	1634	0.19
2-Methylbutyric acid	2.45*	885	0.30	9.97*†	1650	1.42
2-Heptanone	2.45*	885	[0.30]	3.14	1143	tr
Methyl hexanoate	3.02*	926	0.02	3.25	1151	0.01
α-Thujene	3.02*	926	[0.02]	1.51	999	0.01
α-Pinene	3.08	930	0.15	1.44	991	0.14
Camphene	3.28	942	0.05	1.79	1026	0.04
β-Pinene	3.70*	970	0.32	2.20	1066	0.27
Sabinene	3.70*	970	[0.32]	2.39	1084	0.03
Myrcene	4.02	992	0.11	3.00	1132	0.10
α-Phellandrene	4.14*	1000	0.04	2.95	1128	0.04
cis-Dehydroxylinalool oxide	4.14*	1000	[0.04]	3.96†	1204	[2.13]
Caproic acid	4.34	1012	0.03			
α-Terpinene	4.36	1013	0.02	3.09	1139	0.01
para-Cymene	4.47	1020	0.02	4.25	1226	0.02
1,8-Cineole	4.55*†	1026	0.78	3.43	1165	0.46
Limonene	4.55*†	1026	[0.78]	3.32	1156	0.29
(*Z*)-β-Ocimene	4.77	1040	2.18	3.93*†	1203	2.13
(*E*)-β-Ocimene	4.93	1050	2.71	4.14	1218	2.62
γ-Terpinene	5.03	1056	0.03	3.93*†	1203	[2.13]
cis-Sabinene hydrate	5.15	1064	0.01	7.07*	1428	0.25
cis-Linalool oxide (fur.)	5.25	1070	0.20	6.70	1400	0.20
trans-Linalool oxide (fur.)	5.50*	1086	0.27	7.07*	1428	[0.25]
Terpinolene	5.50*	1086	[0.27]	4.44	1239	0.04

Methyl benzoate	5.55	1089	0.02	8.82	1559	0.02
Rosefuran	5.68	1097	0.01	6.17	1362	0.02
Hotrienol	5.86*	1109	66.17	8.99	1572	0.07
Linalool	5.86*	1109	[66.17]	8.31	1520	66.00
endo-Fenchol	5.86*	1109	[66.17]	8.59	1542	0.04
Phenylethyl alcohol	5.91	1112	0.38	12.33*	1850	0.41
Methyl octanoate	6.08	1124	0.01	6.02	1352	0.01
allo-Ocimene	6.20	1131	0.07	5.74	1332	0.06
Linalyl methyl ether?	6.27	1136	0.02			
neo-allo-Ocimene	6.30*	1138	0.02	6.05	1354	tr
Camphor	6.30*	1138	[0.02]	7.38	1451	0.02
Camphene hydrate	6.38	1143	0.02	8.65*	1546	7.58
Nerol oxide	6.57	1155	0.01	7.03	1424	0.02
Borneol	6.68	1162	0.06	9.97*†	1650	[1.42]
Terpinen-4-ol	6.86	1175	0.06	8.76	1554	0.04
α-Terpineol	7.08	1189	0.46	9.97*†	1650	[1.42]
Methylchavicol	7.20	1196	0.06	9.51	1613	0.05
(3*E*,5*E*)-2,6-Dimethylocta-3,5,7-trien-2-ol	7.42	1211	0.03	11.54	1781	0.04
Nerol	7.70	1231	0.09	11.25	1756	0.11
Geraniol	8.12*	1260	0.31	11.82†	1805	0.36
trans-Linalool oxide acetate (pyr.)	8.12*	1260	[0.31]	9.43	1607	0.05
Undec-(5*Z*)-en-2-one	8.36	1277	0.02	9.06	1577	0.02
Safrole	8.44	1282	0.03	11.85†	1808	[0.36]
Indole	8.51	1288	0.05	17.46	2351	0.05
1-Nitro-2-phenylethane	8.55	1290	0.01	14.39	2038	0.02
δ-Elemene	9.30	1337	0.03	7.13	1432	0.03
α-Cubebene	9.47	1349	0.10	6.95	1419	0.09
α-Copaene	9.82	1373	0.35	7.32	1446	0.35
cis-β-Elemene	9.96	1384	0.10	8.46	1532	0.08
β-Cubebene	10.03	1388	0.08	7.96	1493	0.09
β-Elemene	10.07	1391	2.59	8.65*	1546	[7.58]
Methyleugenol	10.26	1405	2.79	13.53	1958	2.79
cis-α-Bergamotene	10.40*	1416	5.07	8.37	1525	0.10
β-Caryophyllene	10.40*	1416	[5.07]	8.65*	1546	[7.58]
β-Copaene	10.54	1426	0.14	8.52	1536	0.10
trans-α-Bergamotene	10.68	1436	0.16	8.65*	1546	[7.58]
Phenylethyl butyrate?	10.74	1441	0.02			
α-Humulene	10.85	1449	0.83	9.48	1610	0.79
allo-Aromadendrene	10.95	1456	0.01	9.19	1588	0.01
(*E*)-β-Farnesene	11.00	1460	0.05	9.73	1631	0.03
Selina-4,11-diene	11.17	1473	0.17	9.61	1622	0.13
γ-Muurolene	11.19	1475	0.08	9.77*	1634	[0.19]
Germacrene D	11.22	1477	0.71	9.97*†	1650	[1.42]

β-Selinene	11.28	1482	0.73	10.06	1658	0.76
Phenylethyl isovalerate	11.32	1484	0.14			
α-Selinene	11.41	1491	0.65	10.13	1663	0.72
Methyl (*E*)-isoeugenol	11.48	1496	0.29	15.22	2120	0.26
Germacrene A	11.53*	1500	0.76	10.57*	1699	0.72
α-Muurolene	11.53*	1500	[0.76]	10.23	1671	0.17
β-Bisabolene	11.66†	1510	0.42	10.34	1680	0.24
γ-Cadinene	11.68*†	1511	[0.42]	10.57*	1699	[0.72]
Cubebol	11.68*†	1511	[0.42]	12.79	1890	0.03
(3*E*,6*E*)-α-Farnesene	11.68*†	1511	[0.42]	10.70	1710	0.16
Unknown [m/z 161, 81 (93), 105 (66), 93 (60), 119 (60), 204 (54)...]	11.73	1516	0.02			
δ-Cadinene	11.81*	1522	0.85	10.62	1703	0.75
Zonarene	11.81*	1522	[0.85]	10.57*	1699	[0.72]
trans-Cadina-1,4-diene	11.91	1529	0.06	10.86	1723	0.06
α-Cadinene	11.98	1535	0.01	10.98	1733	0.01
α-Calacorene	12.01	1538	0.04	12.33*	1850	[0.41]
Isocaryophyllene epoxide B	12.09	1544	0.04	12.33*	1850	[0.41]
α-Elemol	12.12	1546	0.03	14.24	2024	0.04
Elemicin	12.26	1558	0.02	15.80	2177	0.02
(*E*)-Nerolidol	12.36	1566	0.40	13.98*	2000	0.46
Caryophyllene oxide isomer	12.50*	1576	0.43	12.92	1902	0.02
Caryophyllene oxide	12.50*	1576	[0.43]	12.97	1906	0.45
Humulene epoxide II	12.82	1602	0.10	13.56	1961	0.06
Unknown [m/z 43, 81 (97), 135 (71), 95 (62), 204 (61), 71 (59), 207 (56)... 222 (3)]	12.89*	1607	0.08	14.72	2070	0.07
Junenol	12.89*	1607	[0.08]	13.81	1984	0.02
1-epi-Cubenol	13.09	1624	0.08	13.98*	2000	[0.46]
τ-Cadinol	13.27*	1638	0.40	15.09	2106	0.18
τ-Muurolol	13.27*	1638	[0.40]	15.26	2123	0.18
α-Muurolol	13.32	1642	0.05	15.40	2137	0.05
Selin-11-en-4α-ol	13.38	1648	0.21	15.83*	2180	0.19
α-Cadinol	13.41	1650	0.07	15.68	2166	0.07
(3*Z*)-Caryophylla-3,8(13)-dien-5β-ol	13.62	1667	0.12	17.06	2308	0.13
Unknown [m/z 43, 67 (85), 81 (70), 79 (53), 95 (46), 55 (39), 41 (37)...]	15.83	1860	0.02	16.36	2234	0.02
Unknown [m/z 79,	15.93	1868	0.10	16.46	2245	0.10

43 (84), 67 (55), 93 (50), 95 (41), 80 (35)...]						
Nonadecane	16.36	1908	0.02	12.74	1885	0.04
Methyl palmitate	16.61	1932	0.02	15.83*	2180	[0.19]
Methyl linoleate	18.30	2096	0.14	18.29	2442	0.15
Methyl α-linolenate	18.35	2101	0.08	18.85	2505	0.08
Total identified		**97.91%**			**96.81%**	
Total reported		**98.06%**			**97.00%**	

*: 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