Date : January 23, 2019

Certificate of Analysis – GC Profiling

Sample identification

Internal code : 19A10-ORA08-1-CC
Customer identification : Cinnamon
Type : Essential oil
Source : *Cinnamomum zeylanicum*
Customer : Organic Aromas Inc.

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 : January 14, 2019

Checked and approved by :

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

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PHYSICOCHEMICAL DATA

Physical aspect: Light yellow liquid
Refractive index: 1.5583 ± 0.0003 (20 °C)

CONCLUSION

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

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ANALYSIS SUMMARY

Identification	DB-5 (%)	DB-WAX (%)	Classe
Toluene	tr	0.24*	Simple phenolic
Hexanal	0.01	0.01	Aliphatic aldehyde
Ethyl 2-methylbutyrate	0.01	0.03*	Aliphatic ester
Styrene	0.65	0.64	Simple phenolic
Tricyclene	0.01	0.01	Monoterpene
α-Thujene	0.25	[0.24]*	Monoterpene
α-Pinene	1.62	1.59	Monoterpene
Camphene	0.84*	0.81	Monoterpene
α-Fenchene	[0.84]*	[0.03]*	Monoterpene
Thuja-2,4(10)-diene	tr	0.10*	Monoterpene
Benzaldehyde	0.46	0.49	Simple phenolic
β-Pinene	0.64*	0.56	Monoterpene
Sabinene	[0.64]*	[0.10]*	Monoterpene
6-Methyl-5-hepten-2-one	tr	tr	Aliphatic ketone
Myrcene	0.15	0.14	Monoterpene
α-Phellandrene	1.14*	1.09	Monoterpene
Pseudolimonene	[1.14]*	tr	Monoterpene
Octanal	[1.14]*	0.03	Aliphatic aldehyde
Δ3-Carene	0.11	0.11	Monoterpene
α-Terpinene	0.96	0.94	Monoterpene
ortho-Cymene	0.02	2.90*	Simple phenolic
para-Cymene	2.91	[2.90]*	Monoterpene
Limonene	5.45*	1.35	Monoterpene
1,8-Cineole	[5.45]*	4.03*	Monoterpenic ether
β-Phellandrene	[5.45]*	[4.03]*	Monoterpene
Benzyl alcohol	0.03	0.02	Simple phenolic
(*Z*)-β-Ocimene	0.08	0.10	Monoterpene
(*E*)-β-Ocimene	0.03	0.03	Monoterpene
γ-Terpinene	0.14	0.13	Monoterpene
Acetophenone	0.40	0.42	Simple phenolic
cis-Sabinene hydrate	tr	tr	Monoterpenic alcohol
cis-Linalool oxide (fur.)	0.01	0.01	Monoterpenic alcohol
Isoterpinolene	0.01	0.01	Monoterpene
para-Cymenene	0.22*	0.06	Monoterpene
Terpinolene	[0.22]*	0.13	Monoterpene
trans-Linalool oxide (fur.)	[0.22]*	0.03	Monoterpenic alcohol
Linalool	2.93	2.93	Monoterpenic alcohol
(3*E*)-2,7-Dimethyl-3,6-octadien-2-ol	0.08	0.05	Monoterpenic alcohol
endo-Fenchol	0.02	0.01	Monoterpenic alcohol
Phenylethyl alcohol	0.02	0.03*	Simple phenolic
cis-para-Menth-2-en-1-ol	0.07	0.07	Monoterpenic alcohol
α-Campholenal	0.02	0.02	Monoterpenic aldehyde
Cosmene?	0.04		Monoterpene
trans-Pinocarveol	0.03	0.02	Monoterpenic alcohol
Camphor	0.89	0.62	Monoterpenic ketone
Camphene hydrate	0.04	4.40*	Monoterpenic alcohol
Hydrocinnamal	0.43	0.45	Phenylpropanoid
Borneol	0.21	1.01*	Monoterpenic alcohol

Benzyl acetate	0.01	0.02	Phenolic ester
Terpinen-4-ol	0.67	0.65	Monoterpenic alcohol
Cryptone	0.08	0.08	Normonoterpenic ketone
para-Cymen-8-ol	0.06	0.08	Monoterpenic alcohol
Methyl salicylate	0.01	0.01	Phenolic ester
α-Terpineol	0.79	[1.01]*	Monoterpenic alcohol
cis-Piperitol	0.03	0.02	Monoterpenic alcohol
α-Phellandrene epoxide	0.03	0.03	Monoterpenic ether
trans-Piperitol	0.08	0.05	Monoterpenic alcohol
(*Z*)-Cinnamal	0.34	0.34	Phenylpropanoid
Hydrocinnamyl alcohol	0.27	0.40	Phenylpropanoid
ortho-Anisaldehyde	0.04	0.15*	Simple phenolic
Safrole	50.81*	0.10	Phenylpropanoid
(*E*)-Cinnamal	[50.81]*	50.69*	Phenylpropanoid
Chavicol	[50.81]*	0.20	Phenylpropanoid
Carvacrol	0.01	0.01	Monoterpenic alcohol
(*E*)-Cinnamyl alcohol	1.01	0.94	Phenylpropanoid
Hydrocinnamic acid	0.14	0.18	Phenylpropanoid
Eugenol	3.45	3.53	Phenylpropanoid
Hydrocinnamyl acetate	0.16	0.21	Phenylpropanoid ester
ortho-Methoxyhydrocinnamal?	0.02	0.04	Phenylpropanoid
α-Copaene	0.44	0.64	Sesquiterpene
cis-β-Elemene	0.03	0.02	Sesquiterpene
β-Cubebene	0.03	0.04	Sesquiterpene
β-Elemene	0.02	0.02	Sesquiterpene
α-Gurjunene	0.02	0.02	Sesquiterpene
Isocaryophyllene	0.01	0.01	Sesquiterpene
Methyleugenol	0.04	0.05	Phenylpropanoid
β-Caryophyllene	4.40	[4.40]*	Sesquiterpene
Caryophylla-4(12),8(13)-diene	0.05	0.04	Sesquiterpene
(*E*)-Cinnamyl acetate	7.68*	6.95	Phenylpropanoid ester
α-Humulene	[7.68]*	0.87	Sesquiterpene
(*E*)-Isoeugenol	[7.68]*	0.01	Phenylpropanoid
(*E*)-Cinnamic acid	[7.68]	0.16	Phenylpropanoid
allo-Aromadendrene	0.01	0.01	Sesquiterpene
γ-Gurjunene	tr	0.01	Sesquiterpene
trans-Cadina-1(6),4-diene	0.01	0.01	Sesquiterpene
Germacrene D	0.02	[1.01]*	Sesquiterpene
ar-Curcumene	0.14*	0.09	Sesquiterpene
Unknown	[0.14]*	0.02	Sesquiterpene
Bicyclogermacrene	0.04*	0.02	Sesquiterpene
Viridiflorene	[0.04]*	0.03	Sesquiterpene
α-Muurolene	0.01	0.02	Sesquiterpene
2,3-Epoxycinnamyl acetate I?	0.01	0.02	Phenylpropanoid ester
γ-Cadinene	0.06*	0.06	Sesquiterpene
Cubebol	[0.06]*	0.02	Sesquiterpenic alcohol
trans-Calamenene	0.05	0.04	Sesquiterpene
δ-Cadinene	0.07	0.08	Sesquiterpene
(*E*)-ortho-Methoxycinnamal	0.61*	0.58	Phenylpropanoid
Eugenyl acetate	[0.61]*	0.08	Phenylpropanoid ester
trans-Cadina-1,4-diene	[0.61]*	0.01	Sesquiterpene
α-Calacorene	0.03	0.04	Sesquiterpene

Isocaryophyllene epoxide B	tr	[0.03]*	Sesquiterpenic ether
Unknown	0.12	0.13	Phenylpropanoid
β-Calacorene	0.24*	0.03	Sesquiterpene
Caryophyllenyl alcohol	[0.24]*	0.26	Sesquiterpenic alcohol
Spathulenol	0.07	0.07	Sesquiterpenic alcohol
Caryophyllene oxide	0.89*	0.83	Sesquiterpenic ether
Caryophyllene oxide isomer	[0.89]*	0.10	Sesquiterpenic ether
Unknown	0.14	0.15	Oxygenated sesquiterpene
Tetradecanal	0.12	[0.15]*	Aliphatic aldehyde
Humulene epoxide II	0.17	[50.69]*	Sesquiterpenic ether
1,10-diepi-Cubenol	0.05	[50.69]*	Sesquiterpenic alcohol
Caryophylladienol I	0.10	0.02	Sesquiterpenic alcohol
Caryophylladienol II	0.11	0.11	Sesquiterpenic alcohol
τ-Cadinol	0.04*	0.02	Sesquiterpenic alcohol
τ-Muurolol	[0.04]*	0.03	Sesquiterpenic alcohol
Unknown	0.02	0.01	Sesquiterpenic alcohol
(3*Z*)-Caryophylla-3,8(13)-dien-5β-ol	0.14	0.14	Sesquiterpenic alcohol
(*E*)-Coniferyl alcohol	0.01	0.01	Phenylpropanoid
(*E*)-Coniferaldehyde	tr	0.03	Phenylpropanoid
Benzyl benzoate	1.13	1.17	Phenolic ester
Phenylethyl benzoate	0.01	0.01	Phenolic ester
Unknown	0.17		Unknown
Unknown	0.14		Unknown
Unknown	0.08	0.05	Unknown
Unknown	0.03		Lignan
Total identified	**95.83%**	**96.13%**	

*: 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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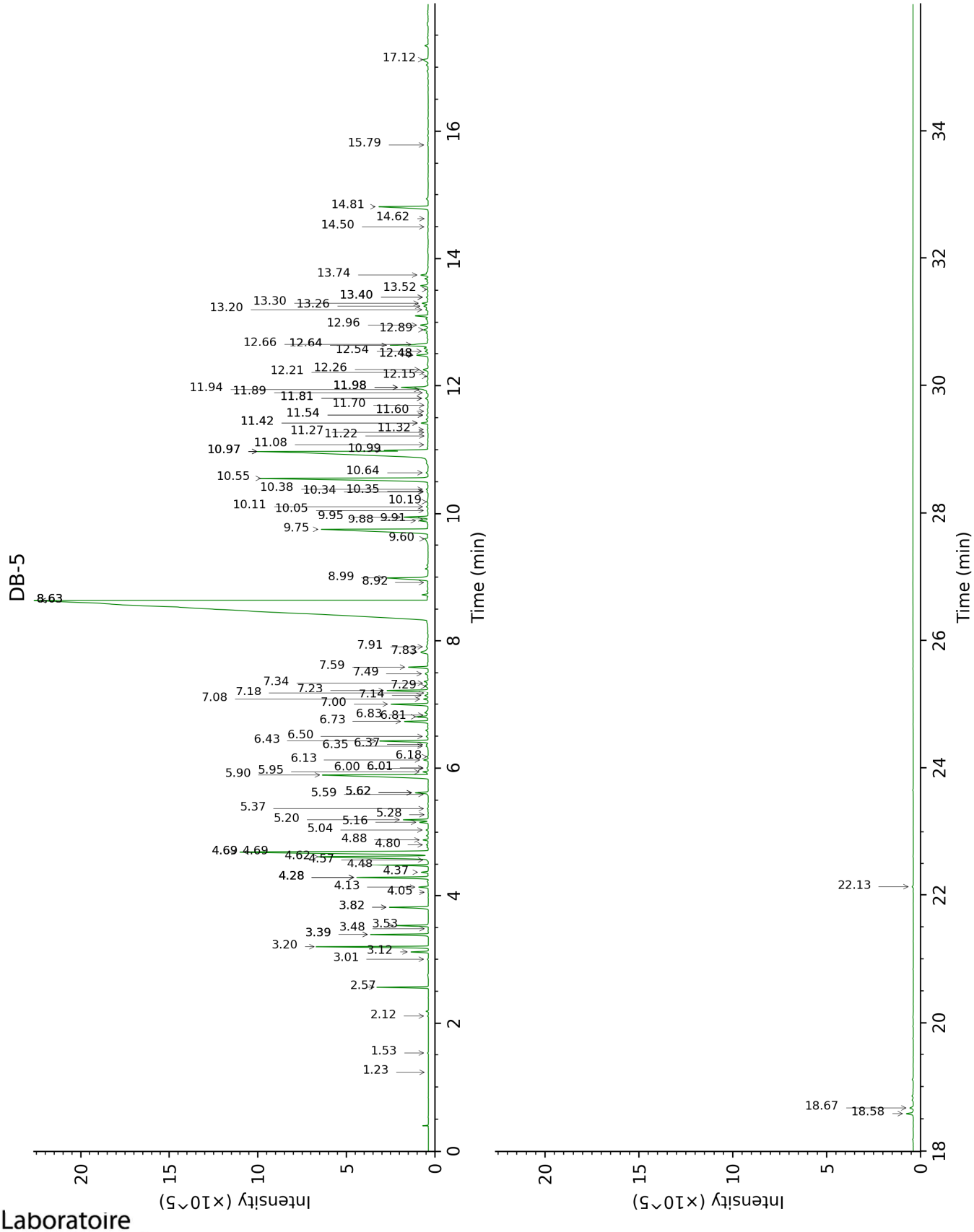
DB-5
Time (min)
Intensity (×10^5)
17.12
15.79
14.81
14.62
14.50
13.74
13.52
13.40
13.30
13.26
13.20
12.96
12.89
12.66
12.64
12.54
12.48
12.26
12.21
12.15
11.98
11.94
11.89
11.81
11.70
11.60
11.54
11.42
11.32
11.27
11.22
11.08
10.99
10.97
10.64
10.55
10.38
10.34
10.35
10.19
10.11
10.05
9.95
9.88
9.91
9.75
9.60
8.99
8.92
8.63
7.91
7.83
7.59
7.49
7.34
7.29
7.23
7.18
7.14
7.08
7.00
6.83
6.81
6.73
6.50
6.43
6.37
6.35
6.18
6.13
6.00
6.01
5.95
5.90
5.62
5.59
5.37
5.28
5.20
5.16
5.04
4.88
4.80
4.69
4.69
4.62
4.57
4.48
4.37
4.28
4.13
4.05
3.82
3.53
3.48
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3.12
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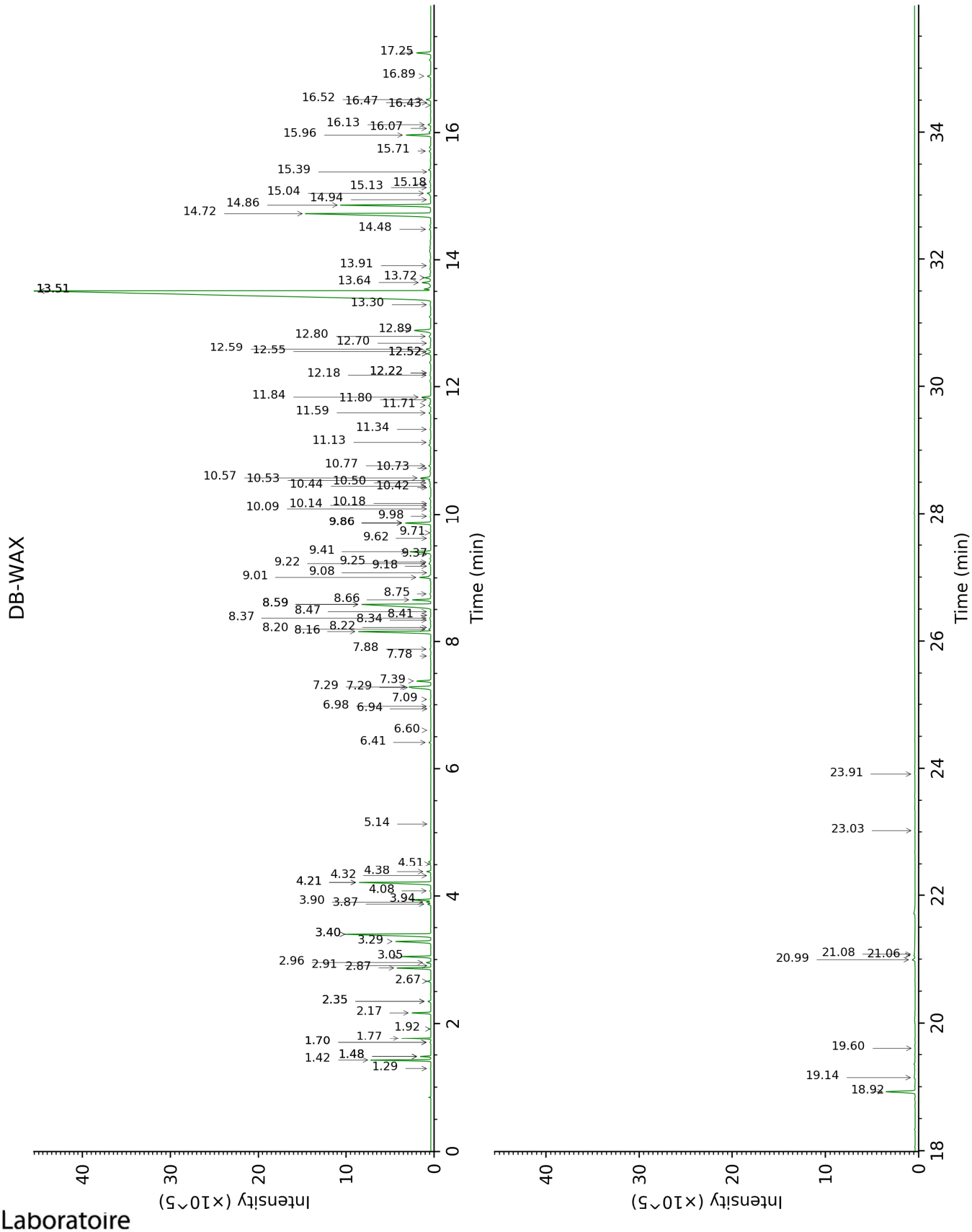
2.12
1.53
1.23
22.13
18.67
18.58


DB-WAX
Time (min)
Intensity (×10^5)
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16.89
16.52
16.47
16.43
16.13
16.07
15.96
15.71
15.39
15.13
15.18
15.04
14.94
14.86
14.72
14.48
13.91
13.64
13.72
13.51
13.30
12.89
12.80
12.70
12.59
12.55
12.52
12.18
12.22
11.84
11.80
11.71
11.59
11.34
11.13
10.77
10.73
10.57
10.53
10.50
10.44
10.42
10.18
10.14
10.09
9.98
9.86
9.71
9.62
9.41
9.37
9.25
9.22
9.18
9.08
9.01
8.75
8.66
8.59
8.47
8.41
8.37
8.34
8.22
8.20
8.16
7.88
7.78
7.39
7.29
7.29
7.09
6.98
6.94
6.60
6.41
5.14
4.51
4.38
4.32
4.21
4.08
3.94
3.90
3.87
3.40
3.29
3.05
2.96
2.91
2.87
2.67
2.35
2.17
1.92
1.77
1.70
1.48
1.42
1.29
23.91
23.03
21.08
21.06
20.99
19.60
19.14
18.92

FULL ANALYSIS DATA

Identification	Column DB-5			Column DB-WAX		
	R.T	R.I	%	R.T	R.I	%
Toluene	1.23	756	tr	1.48*	1003	0.24
Hexanal	1.53	796	0.01	1.92	1044	0.01
Ethyl 2-methylbutyrate	2.12	848	0.01	1.70*	1023	0.03
Styrene	2.57	884	0.65	3.94	1213	0.64
Tricyclene	3.01	917	0.01	1.29	975	0.01
α-Thujene	3.12	924	0.25	1.48*	1003	[0.24]
α-Pinene	3.20	930	1.62	1.42	995	1.59
Camphene	3.39*	942	0.84	1.77	1030	0.81
α-Fenchene	3.39*	942	[0.84]	1.70*	1023	[0.03]
Thuja-2,4(10)-diene	3.48	948	tr	2.35*	1085	0.10
Benzaldehyde	3.53	952	0.46	7.39	1460	0.49
β-Pinene	3.82*	970	0.64	2.17	1068	0.56
Sabinene	3.82*	970	[0.64]	2.35*	1085	[0.10]
6-Methyl-5-hepten-2-one	4.05	986	tr	5.14	1305	tr
Myrcene	4.13	991	0.15	2.96	1135	0.14
α-Phellandrene	4.28*	1001	1.14	2.87	1129	1.09
Pseudolimonene	4.28*	1001	[1.14]	2.91	1132	tr
Octanal	4.28*	1001	[1.14]	4.51	1256	0.03
Δ3-Carene	4.37	1006	0.11	2.66	1112	0.11
α-Terpinene	4.48	1014	0.96	3.05	1143	0.94
ortho-Cymene	4.57	1019	0.02	4.21*	1234	2.90
para-Cymene	4.62	1022	2.91	4.21*	1234	[2.90]
Limonene	4.69*	1027	5.45	3.29	1161	1.35
1,8-Cineole	4.69*	1027	[5.45]	3.40*	1170	4.03
β-Phellandrene	4.69*	1027	[5.45]	3.40*	1170	[4.03]
Benzyl alcohol	4.80	1034	0.03	11.80	1818	0.02
(*Z*)-β-Ocimene	4.88	1039	0.08	3.87	1208	0.10
(*E*)-β-Ocimene	5.04	1048	0.03	4.08	1224	0.03
γ-Terpinene	5.16	1056	0.14	3.90	1210	0.13
Acetophenone	5.20	1058	0.40	9.01	1585	0.42
cis-Sabinene hydrate	5.28	1064	tr	6.94	1427	tr
cis-Linalool oxide (fur.)	5.37	1070	0.01	6.60	1401	0.01
Isoterpinolene	5.59	1084	0.01	4.32	1242	0.01
para-Cymenene	5.62*	1085	0.22	6.41	1388	0.06
Terpinolene	5.62*	1085	[0.22]	4.38	1247	0.13
trans-Linalool oxide (fur.)	5.62*	1085	[0.22]	6.98	1430	0.03
Linalool	5.90	1103	2.93	8.16	1519	2.93
(3*E*)-2,7-Dimethyl-3,6-octadien-2-ol	5.95	1106	0.08	8.37	1535	0.05
endo-Fenchol	6.00	1110	0.02	8.42	1539	0.01
Phenylethyl alcohol	6.01	1110	0.02	12.22*	1856	0.03
cis-para-Menth-2-en-1-ol	6.13	1118	0.07	8.20	1522	0.07
α-Campholenal	6.18	1121	0.02	7.09	1438	0.02
Cosmene?	6.35	1132	0.04			
trans-Pinocarveol	6.37	1133	0.03	9.25	1604	0.02
Camphor	6.43	1137	0.89	7.28	1452	0.62
Camphene hydrate	6.50	1142	0.04	8.58*	1552	4.40

Hydrocinnamal	6.73	1157	0.43	10.58	1713	0.45
Borneol	6.81	1162	0.21	9.86*	1654	1.01
Benzyl acetate	6.83	1163	0.01	10.09	1673	0.02
Terpinen-4-ol	7.00	1174	0.67	8.66	1558	0.65
Cryptone	7.08	1180	0.08	9.22	1602	0.08
para-Cymen-8-ol	7.14	1183	0.06	11.59	1800	0.08
Methyl salicylate	7.18	1186	0.01	10.42	1700	0.01
α-Terpineol	7.23	1189	0.79	9.86*	1654	[1.01]
cis-Piperitol	7.29	1193	0.03	9.62	1634	0.02
α-Phellandrene epoxide	7.34	1196	0.03	11.13	1760	0.03
trans-Piperitol	7.49	1206	0.08	10.44	1702	0.05
(*Z*)-Cinnamal	7.59	1213	0.34	11.84	1822	0.34
Hydrocinnamyl alcohol	7.83	1229	0.27	13.64	1986	0.40
ortho-Anisaldehyde	7.91	1235	0.04	12.52*	1882	0.15
Safrole	8.64*	1284	50.81	11.71	1810	0.10
(*E*)-Cinnamal	8.64*	1284	[50.81]	13.51*†	1974	50.69
Chavicol	8.64*	1284	[50.81]	16.52	2273	0.20
Carvacrol	8.92	1304	0.01	15.39	2156	0.01
(*E*)-Cinnamyl alcohol	8.99	1305	1.01	15.96	2215	0.94
Hydrocinnamic acid	9.60	1348	0.14	19.14	2564	0.18
Eugenol	9.75	1359	3.45	14.86	2103	3.53
Hydrocinnamyl acetate	9.88	1369	0.16	12.59	1889	0.21
ortho-Methoxyhydrocinnamal?	9.91	1371	0.02	13.91	2011	0.04
α-Copaene	9.95	1373	0.44	7.29	1453	0.64
cis-β-Elemene	10.05	1381	0.03	8.34	1533	0.02
β-Cubebene	10.11	1385	0.03	7.88	1498	0.04
β-Elemene	10.19	1390	0.02	8.47	1543	0.02
α-Gurjunene	10.34	1401	0.02	7.78	1489	0.02
Isocaryophyllene	10.35	1402	0.01	8.22	1524	0.01
Methyleugenol	10.38	1404	0.04	13.30	1954	0.05
β-Caryophyllene	10.56	1417	4.40	8.58*	1552	[4.40]
Caryophylla-4(12),8(13)-diene	10.64	1424	0.05	8.75	1565	0.04
(*E*)-Cinnamyl acetate	10.98*†	1448	7.68	14.72	2090	6.95
α-Humulene	10.98*†	1448	[7.68]	9.41	1617	0.87
(*E*)-Isoeugenol	10.98*†	1448	[7.68]	16.47	2268	0.01
(*E*)-Cinnamic acid	10.99†	1450	[7.68]	21.08	2798	0.16
allo-Aromadendrene	11.08	1456	0.01	9.08	1591	0.01
γ-Gurjunene	11.22	1467	tr	9.18	1599	0.01
trans-Cadina-1(6),4-diene	11.27	1471	0.01	9.37	1614	0.01
Germacrene D	11.32	1474	0.02	9.86*	1654	[1.01]
ar-Curcumene	11.42*	1482	0.14	10.77	1729	0.09
Unknown [m/z 91, 93 (92), 105 (71), 77 (69), 79 (68), 133 (63)... 204 (32)]	11.42*	1482	[0.14]	9.98	1664	0.02
Bicyclogermacrene	11.54*	1491	0.04	10.18	1680	0.02
Viridiflorene	11.54*	1491	[0.04]	9.71	1642	0.03
α-Muurolene	11.60	1496	0.01	10.14	1677	0.02
2,3-Epoxycinnamyl acetate I?	11.70	1503	0.01	16.43	2264	0.02

γ-Cadinene	11.81*	1511	0.06	10.50	1706	0.06
Cubebol	11.81*	1511	[0.06]	12.55	1886	0.02
trans-Calamenene	11.89	1518	0.05	11.34	1778	0.04
δ-Cadinene	11.94	1522	0.07	10.53	1710	0.08
(*E*)-ortho-Methoxycinnamal	11.98*	1524	0.61	17.25	2351	0.58
Eugenyl acetate	11.98*	1524	[0.61]	15.71	2189	0.08
trans-Cadina-1,4-diene	11.98*	1524	[0.61]	10.73	1726	0.01
α-Calacorene	12.15	1538	0.03	12.18	1852	0.04
Isocaryophyllene epoxide B	12.21	1543	tr	12.22*	1856	[0.03]
Unknown [m/z 180, 93 (70), 55 (62), 77 (55), 164 (55), 103 (50)]	12.26	1546	0.12	20.99	2787	0.13
β-Calacorene	12.48*	1564	0.24	12.70	1898	0.03
Caryophyllenyl alcohol	12.48*	1564	[0.24]	13.72	1993	0.26
Spathulenol	12.54	1569	0.07	14.48	2066	0.07
Caryophyllene oxide	12.64*	1577	0.89	12.90	1917	0.83
Caryophyllene oxide isomer	12.64*	1577	[0.89]	12.80	1908	0.10
Unknown [m/z 161, 159 (69), 91 (41), 187 (38), 105 (37), 146 (35), 131 (34)...]	12.66	1578	0.14	15.04	2122	0.15
Tetradecanal	12.89	1596	0.12	12.52*	1882	[0.15]
Humulene epoxide II	12.96	1602	0.17	13.51*†	1974	[50.69]
1,10-diepi-Cubenol	13.20	1622	0.05	13.51*†	1974	[50.69]
Caryophylladienol I	13.26	1626	0.10	16.07	2226	0.02
Caryophylladienol II	13.30	1630	0.11	16.13	2232	0.11
τ-Cadinol	13.40*	1638	0.04	14.94	2112	0.02
τ-Muurolol	13.40*	1638	[0.04]	15.13	2131	0.03
Unknown cadinol analog II [m/z 95, 121 (73), 43 (57), 79 (43), 161 (43), 109)40)... 204 (35), 222 (2)]	13.52	1648	0.02	15.18	2136	0.01
(3*Z*)-Caryophylla-3,8(13)-dien-5β-ol	13.74	1667	0.14	16.89	2312	0.14
(*E*)-Coniferyl alcohol	14.50	1730	0.01	23.03	3053	0.01
(*E*)-Coniferaldehyde	14.62	1742	tr	23.91	3175	0.03
Benzyl benzoate	14.81	1758	1.13	18.92	2538	1.17
Phenylethyl benzoate	15.79	1844	0.01	19.60	2617	0.01
Unknown [m/z 93, 92 (57), 136 (34), 91 (23), 77 (13), 134 (11)...]	17.12	1968	0.17			
Unknown [m/z 69, 91 (57), 41 (49), 181 (32), 169 (25), 167 (22)...]	18.58	2112	0.14			
Unknown [m/z 69, 91 (56), 41 (49), 169 (34), 239 (28), 93 (23)...]	18.67	2121	0.08	21.06	2796	0.05
Unknown [m/z 326, 148	22.13	2501	0.03			

(67), 147 (41), 117 (30), 91 (22)...]		
Total identified	**95.83%**	**96.13%**
Total reported	**96.52%**	**96.49%**

*: 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

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