Date : March 22, 2019

Certificate of Analysis – GC Profiling

Sample identification

Internal code : 19C11-PTH01-1-SCC
Customer identification : Cinnamon Cassia - China - CA010483R
Type : Essential oil
Source : *Cinnamomum cassia*
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 : March 18, 2019

Checked and approved by :

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

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Physicochemical data

Physical aspect: Yellow viscous liquid
Refractive index: 1.6038 ± 0.0003 (20 °C)

ISO 3216:1997 - Oil of cassia

Compound	Min. %	Max. %	Observed %	Complies?
(Z)-Cinnamal	0	0.7	0.2	Yes
Benzeneacetaldehyde	0	0.7	ND	Yes
Styrene	0	0.15	0.14	Yes
(E)-Cinnamyl alcohol	0	1	0	Yes
(E)-Cinnamyl acetate	0	6	3	Yes
Phenylethyl alcohol	0	0.5	0.6	No
Salicylaldehyde	0.2	1.0	0.2	Yes
Acetophenone	0	0.1	0	Yes
Benzaldehyde	0.5	2.0	0.8	Yes
(E)-ortho-Methoxycinnamyl acetate	0	2	0	Yes
(E)-ortho-Methoxycinnamal	3	15	9	Yes
Coumarin	1.5	4.0	1.9	Yes
Eugenol	0	0.5	0	Yes
(E)-Cinnamal	70	88	76	Yes
Refractive index	1.6000	1.6140	1.6038	Yes

Conclusion

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

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ANALYSIS SUMMARY

Identification	DB-5 (%)	DB-WAX (%)	Classe
Hexanal	0.01	0.01	Aliphatic aldehyde
Furfural	0.01	0.02	Aliphatic alcohol
(2*E*)-Hexenal	tr	0.01	Aliphatic aldehyde
Ethylbenzene	0.02	0.02	Simple phenolic
Styrene	0.14	0.15*	Simple phenolic
Tricyclene	0.01		Monoterpene
α-Pinene	0.08	0.07	Monoterpene
Camphene	0.06*	0.05	Monoterpene
α-Fenchene	[0.06]*	tr	Monoterpene
Benzaldehyde	0.84	0.85	Simple phenolic
β-Pinene	0.03	0.02	Monoterpene
6-Methyl-5-hepten-2-one	0.02	0.02	Aliphatic ketone
Benzofuran	0.01		Simple phenolic
Myrcene	0.01		Monoterpene
Octanal	0.01	0.01	Aliphatic aldehyde
para-Cymene	0.04	0.04	Monoterpene
Limonene	0.04*	0.03	Monoterpene
β-Phellandrene	[0.04]*	0.01*	Monoterpene
1,8-Cineole	[0.04]*	[0.01]*	Monoterpenic ether
Salicylaldehyde	0.22	0.22	Simple phenolic
γ-Terpinene	0.01	[0.15]*	Monoterpene
Acetophenone	0.04	0.05*	Simple phenolic
Terpinolene	0.04*	0.01	Monoterpene
para-Cymenene	[0.04]*	0.01	Monoterpene
ortho-Guaiacol	[0.04]*	0.01	Simple phenolic
Linalool	0.01	0.02	Monoterpenic alcohol
Nonanal	0.01	0.01	Aliphatic aldehyde
Phenylethyl alcohol	0.61	0.64	Simple phenolic
ortho-Vinylanisole	0.04*	[0.05]*	Simple phenolic
trans-Pinocarveol	[0.04]*	0.02	Monoterpenic alcohol
2-Methylbenzofuran	0.02	0.03	Phenylpropanoid
Hydrocinnamal	0.61*	0.60	Phenylpropanoid
Unknown	[0.61]*	0.01	Phenylpropanoid
Borneol	0.23	0.12*	Monoterpenic alcohol
3-Methylbenzofuran?	[0.23]	0.12*	Phenylpropanoid
Terpinen-4-ol	0.04	0.02	Monoterpenic alcohol
Methyl salicylate	0.01	0.14*	Phenolic ester
α-Terpineol	0.04	[0.12]*	Monoterpenic alcohol
(*Z*)-Cinnamal	0.24	0.27	Phenylpropanoid
Hydrocinnamyl alcohol	0.11	0.19	Phenylpropanoid
ortho-Anisaldehyde	0.43	0.42*	Simple phenolic
Phenylethyl acetate	0.05	0.06	Phenolic ester
(*E*)-Cinnamal	75.62	75.29*	Phenylpropanoid
(*E*)-Cinnamyl alcohol	0.17	0.19	Phenylpropanoid
Hydrocinnamic acid	0.07	0.10	Phenylpropanoid
Eugenol	0.03	0.03	Phenylpropanoid
Cyclosativene I	0.05	0.03	Sesquiterpene
Cyclosativene II	0.04	0.02	Sesquiterpene

α-Ylangene	0.26	0.32*	Sesquiterpene
ortho-Methoxyhydrocinnamal?	0.32*	0.23	Phenylpropanoid
α-Copaene	[0.32]*	[0.32]*	Sesquiterpene
β-Elemene	0.02	0.15*	Sesquiterpene
β-Caryophyllene	0.10*	[0.15]*	Sesquiterpene
cis-α-Bergamotene	[0.10]*	0.04	Sesquiterpene
Coumarin	1.89	1.89	Coumarin
trans-α-Bergamotene	0.12	[0.15]*	Sesquiterpene
(*E*)-Cinnamic acid	3.72*	0.46	Phenylpropanoid
(*E*)-Cinnamyl acetate	[3.72]*	3.34	Phenylpropanoid ester
(*Z*)-ortho-Methoxycinnamal	0.08*	0.03	Phenylpropanoid
allo-Aromadendrene	[0.08]*	0.06	Sesquiterpene
(*E*)-β-Farnesene	0.03	0.02	Sesquiterpene
γ-Muurolene	0.13	0.14	Sesquiterpene
ar-Curcumene	0.11	0.14	Sesquiterpene
Viridiflorene	0.06	0.04	Sesquiterpene
α-Muurolene	0.10	0.10	Sesquiterpene
β-Bisabolene	0.20	[0.12]*	Sesquiterpene
γ-Cadinene	[0.20]	0.07	Sesquiterpene
δ-Cadinene	0.18*	[0.14]*	Sesquiterpene
trans-Calamenene	[0.18]*	0.04	Sesquiterpene
(*E*)-ortho-Methoxycinnamal	9.30	9.20	Phenylpropanoid
α-Calacorene	0.07	0.03	Sesquiterpene
(*E*)-α-Bisabolene	0.05	0.09	Sesquiterpene
(*E*)-Nerolidol	0.10	0.11*	Sesquiterpenic alcohol
Spathulenol	0.09	0.10	Sesquiterpenic alcohol
Caryophyllene oxide	0.06	0.04	Sesquiterpenic ether
Humulene epoxide II	0.01	[75.29]*	Sesquiterpenic ether
Tetradecanal	0.04	[0.42]*	Aliphatic aldehyde
1-epi-Cubenol	0.03	[0.11]*	Sesquiterpenic alcohol
Caryophylladienol II	0.03	0.03	Sesquiterpenic alcohol
τ-Cadinol	0.06*	0.04	Sesquiterpenic alcohol
τ-Muurolol	[0.06]*	0.03	Sesquiterpenic alcohol
α-Muurolol	0.02	0.03	Sesquiterpenic alcohol
α-Cadinol	0.03	0.04	Sesquiterpenic alcohol
(3*Z*)-Caryophylla-3,8(13)-dien-5β-ol	0.42*	0.02	Sesquiterpenic alcohol
Cadalene	[0.42]*	0.01	Sesquiterpene
(*E*)-ortho-Methoxycinnamyl acetate	[0.42]*	0.34	Phenylpropanoid ester
α-Bisabolol	0.02	0.06	Sesquiterpenic alcohol
Benzyl benzoate	0.11	0.10	Phenolic ester
Phenylethyl benzoate	0.10	0.07	Phenolic ester
Benzyl salicylate	0.02	0.02	Phenolic ester
Dolabradiene	0.13	0.02	Diterpene
Kaurene?	0.02		Diterpene
Total identified	**98.07%**	**97.37%**	

*: 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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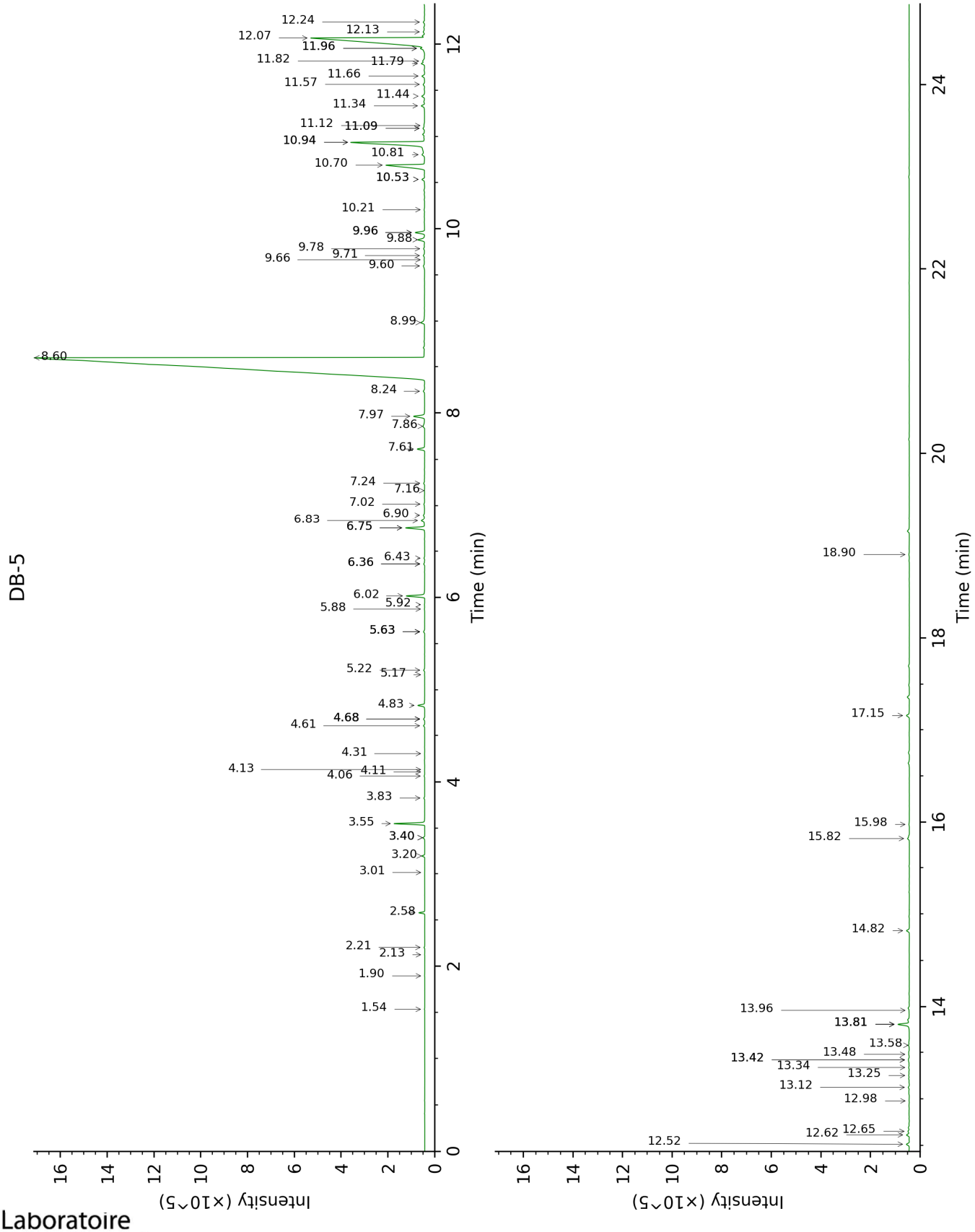
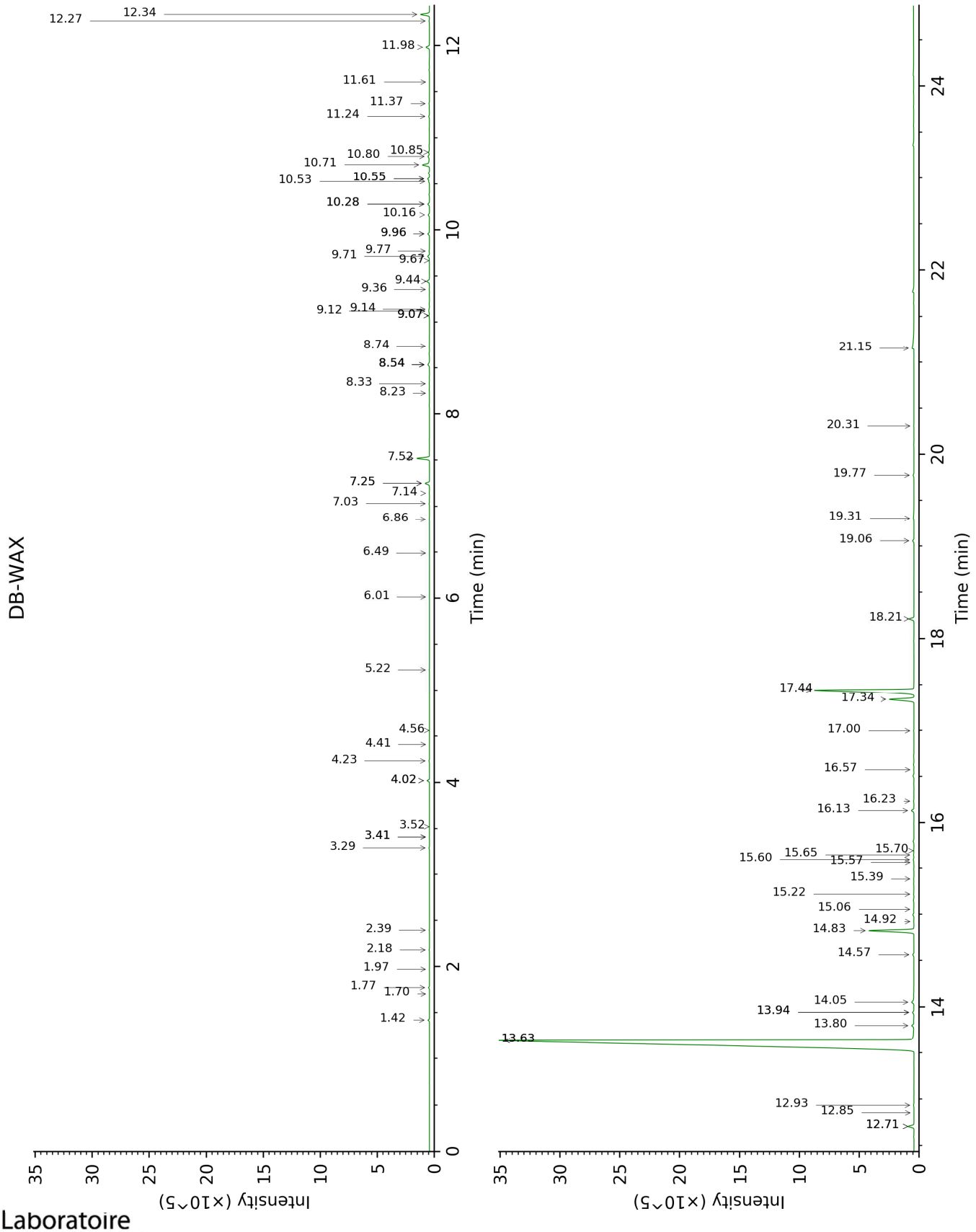

DB-5
Time (min)
Intensity (×10^5)
12.24
12.13
12.07
11.96
11.82
11.79
11.66
11.57
11.44
11.34
11.12
11.09
10.94
10.81
10.70
10.53
10.21
9.96
9.88
9.78
9.71
9.66
9.60
8.99
8.60
8.24
7.97
7.86
7.61
7.24
7.16
7.02
6.90
6.83
6.75
6.43
6.36
6.02
5.92
5.88
5.63
5.22
5.17
4.83
4.68
4.61
4.31
4.13
4.11
4.06
3.83
3.55
3.40
3.20
3.01
2.58
2.21
2.13
1.90
1.54
18.90
17.15
15.98
15.82
14.82
13.96
13.81
13.58
13.48
13.42
13.34
13.25
13.12
12.98
12.65
12.62
12.52


DB-WAX
12.27
12.34
11.98
11.61
11.37
11.24
10.80
10.85
10.71
10.53
10.55
10.28
10.16
9.96
9.71
9.77
9.67
9.44
9.36
9.12
9.14
9.07
8.74
8.54
8.33
8.23
7.52
7.25
7.14
7.03
6.86
6.49
6.01
5.22
4.56
4.41
4.23
4.02
3.52
3.41
3.29
2.39
2.18
1.97
1.77
1.70
1.42
Time (min)
Intensity (×10^5)
21.15
20.31
19.77
19.31
19.06
18.21
17.44
17.34
17.00
16.57
16.23
16.13
15.70
15.65
15.60
15.57
15.39
15.22
15.06
14.92
14.83
14.57
14.05
13.94
13.80
13.63
12.93
12.85
12.71
Time (min)
Intensity (×10^5)

FULL ANALYSIS DATA

Identification	Column DB-5			Column DB-WAX		
	R.T	R.I	%	R.T	R.I	%
Hexanal	1.54	797	0.01	1.97	1046	0.01
Furfural	1.90	829	0.01	6.86	1416	0.02
(2*E*)-Hexenal	2.13	847	tr	3.52	1176	0.01
Ethylbenzene	2.20	854	0.02	2.39	1087	0.02
Styrene	2.58	884	0.14	4.02*	1212	0.15
Tricyclene	3.01	917	0.01			
α-Pinene	3.20	929	0.08	1.42	992	0.07
Camphene	3.40*	942	0.06	1.77	1027	0.05
α-Fenchene	3.40*	942	[0.06]	1.70	1020	tr
Benzaldehyde	3.55	952	0.84	7.52	1465	0.85
β-Pinene	3.83	970	0.03	2.18	1066	0.02
6-Methyl-5-hepten-2-one	4.06	986	0.02	5.22	1299	0.02
Benzofuran	4.11	989	0.01			
Myrcene	4.13	990	0.01			
Octanal	4.31	1002	0.01	4.56	1251	0.01
para-Cymene	4.61	1021	0.04	4.23	1228	0.04
Limonene	4.68*	1025	0.04	3.29	1158	0.03
β-Phellandrene	4.68*	1025	[0.04]	3.41*	1167	0.01
1,8-Cineole	4.68*	1025	[0.04]	3.41*	1167	[0.01]
Salicylaldehyde	4.83	1035	0.22	9.44	1613	0.22
γ-Terpinene	5.17	1056	0.01	4.02*	1212	[0.15]
Acetophenone	5.22	1059	0.04	9.07*	1584	0.05
Terpinolene	5.63*	1085	0.04	4.41	1240	0.01
para-Cymenene	5.63*	1085	[0.04]	6.49	1389	0.01
ortho-Guaiacol	5.63*	1085	[0.04]	11.61	1792	0.01
Linalool	5.88	1101	0.01	8.23	1518	0.02
Nonanal	5.92	1104	0.01	6.01	1355	0.01
Phenylethyl alcohol	6.02	1110	0.61	12.34	1857	0.64
ortho-Vinylanisole	6.36*	1132	0.04	9.07*	1584	[0.05]
trans-Pinocarveol	6.36*	1132	[0.04]	9.36	1606	0.02
2-Methylbenzofuran	6.43	1136	0.02	9.14	1589	0.03
Hydrocinnamal	6.75*	1158	0.61	10.71	1717	0.60
Unknown [m/z 133, 77 (86), 105 (75), 79 (68), 134 (48)]	6.75*	1158	[0.61]	12.85	1903	0.01
Borneol	6.83†	1163	0.23	9.96*	1655	0.12
3-Methylbenzofuran?	6.90†	1167	[0.23]	10.28*	1681	0.12
Terpinen-4-ol	7.02	1175	0.04	8.74	1558	0.02
Methyl salicylate	7.16	1184	0.01	10.55*	1703	0.14
α-Terpineol	7.24	1189	0.04	9.96*	1655	[0.12]
(*Z*)-Cinnamal	7.61	1214	0.24	11.98	1826	0.27
Hydrocinnamyl alcohol	7.86	1230	0.11	13.80	1990	0.19
ortho-Anisaldehyde	7.97	1238	0.43	12.71*	1889	0.42
Phenylethyl acetate	8.24	1256	0.05	11.24	1761	0.06
(*E*)-Cinnamal	8.60	1281	75.62	13.63*	1974	75.29
(*E*)-Cinnamyl alcohol	8.99	1302	0.17	16.13	2220	0.19
Hydrocinnamic acid	9.60	1346	0.07	19.31	2568	0.10

Eugenol	9.66	1350	0.03	14.92	2098	0.03
Cyclosativene I	9.71	1354	0.05	7.03	1429	0.03
Cyclosativene II	9.78	1359	0.04	7.14	1438	0.02
α-Ylangene	9.88	1366	0.26	7.25*	1446	0.32
ortho-Methoxyhydrocinnamal?	9.96*	1371	0.32	14.05	2014	0.23
α-Copaene	9.96*	1371	[0.32]	7.25*	1446	[0.32]
β-Elemene	10.21	1389	0.02	8.54*	1542	0.15
β-Caryophyllene	10.53*	1412	0.10	8.54*	1542	[0.15]
cis-α-Bergamotene	10.53*	1412	[0.10]	8.33	1526	0.04
Coumarin	10.70	1425	1.89	17.34	2347	1.89
trans-α-Bergamotene	10.81	1433	0.12	8.54*	1542	[0.15]
(*E*)-Cinnamic acid	10.94*	1443	3.72	21.15	2793	0.46
(*E*)-Cinnamyl acetate	10.94*	1443	[3.72]	14.83	2088	3.34
(*Z*)-ortho-Methoxycinnamal	11.09*	1454	0.08	15.70	2175	0.03
allo-Aromadendrene	11.09*	1454	[0.08]	9.12	1587	0.06
(*E*)-β-Farnesene	11.12	1456	0.03	9.67	1631	0.02
γ-Muurolene	11.34	1472	0.13	9.71	1635	0.14
ar-Curcumene	11.44	1480	0.11	10.80	1724	0.14
Viridiflorene	11.57	1490	0.06	9.77	1640	0.04
α-Muurolene	11.66	1496	0.10	10.16	1671	0.10
β-Bisabolene	11.79†	1507	0.20	10.28*	1681	[0.12]
γ-Cadinene	11.82†	1509	[0.20]	10.53	1701	0.07
δ-Cadinene	11.96*	1520	0.18	10.55*	1703	[0.14]
trans-Calamenene	11.96*	1520	[0.18]	11.37	1772	0.04
(*E*)-ortho-Methoxycinnamal	12.07	1528	9.30	17.44	2358	9.20
α-Calacorene	12.14	1534	0.07	12.27	1850	0.03
(*E*)-α-Bisabolene	12.24	1542	0.05	10.85	1728	0.09
(*E*)-Nerolidol	12.52	1564	0.10	13.94*	2003	0.11
Spathulenol	12.62	1572	0.09	14.57	2063	0.10
Caryophyllene oxide	12.65	1574	0.06	12.93	1910	0.04
Humulene epoxide II	12.98	1600	0.01	13.63*	1974	[75.29]
Tetradecanal	13.12	1612	0.04	12.71*	1889	[0.42]
1-epi-Cubenol	13.25	1623	0.03	13.94*	2003	[0.11]
Caryophylladienol II	13.34	1630	0.03	16.23	2230	0.03
τ-Cadinol	13.42*	1636	0.06	15.06	2111	0.04
τ-Muurolol	13.42*	1636	[0.06]	15.22	2127	0.03
α-Muurolol	13.48	1641	0.02	15.39	2144	0.03
α-Cadinol	13.58	1649	0.03	15.65	2170	0.04
(3*Z*)-Caryophylla-3,8(13)-dien-5β-ol	13.81*	1669	0.42	17.00	2310	0.02
Cadalene	13.81*	1669	[0.42]	15.57	2162	0.01
(*E*)-ortho-Methoxycinnamyl acetate	13.81*	1669	[0.42]	18.21	2444	0.34
α-Bisabolol	13.96	1681	0.02	15.60	2165	0.06
Benzyl benzoate	14.82	1755	0.11	19.06	2540	0.10
Phenylethyl benzoate	15.82	1844	0.10	19.78	2624	0.07
Benzyl salicylate	15.98	1858	0.02	20.31	2688	0.02
Dolabradiene	17.15	1967	0.13	16.57	2266	0.02

Kaurene?	18.90	2140	0.02	
Total identified		**98.07%**		**97.37%**
Total reported		**98.07%**		**97.38%**

*: 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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