Date : November 25, 2020

Certificate of Analysis – GC Profiling

Sample identification

Internal code : 20K24-PTH03
Customer identification : Cardamom - Guatemala - CA3107912R
Type : Essential oil
Source : *Elettaria cardamomum*
Customer : Plant Therapy

Analysis

Method: PC-MAT-014 ISO - 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 : November 25, 2020

Checked and approved by :

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

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Méthode certifiée ISO 17025:2017 Certified method

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Physicochemical data

Physical aspect: Faintly yellow liquid
Refractive index: 1.4632 ± 0.0003 (20 °C; method PC-MAT-016)

ISO 4733:2004 - Oil of cardamom - Central America

Compound	Min. %	Max. %	Observed %	Complies?
(E)-Nerolidol	0.5	1.0	0.8	Yes
α-Terpinyl acetate	35	45	36	Yes
α-Terpineol	tr	2.50	1.27	Yes
Terpinen-4-ol	0.8	1.5	0.7	No
Linalyl acetate	4	6	5	Yes
Linalool	3	6	3	Yes
1,8-Cineole	27	35	32	Yes
Limonene	2.0	3.0	2.7	Yes
Myrcene	tr	2.50	2.26	Yes
Sabinene	3	5	5	Yes
α-Pinene	1.0	2.0	1.9	Yes
Refractive index	1.4600	1.4670	1.4632	Yes

Conclusion

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

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Analysis summary – Consolidated contents

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

Identification	%	Class
Isobutyral	tr	Aliphatic aldehyde
Isovaleral	0.02	Aliphatic aldehyde
2-Methylbutyral	0.01	Aliphatic aldehyde
Isoamyl alcohol	0.01	Aliphatic alcohol
2-Methylbutanol	0.02	Aliphatic alcohol
Hexanal	0.02	Aliphatic aldehyde
Isoamyl acetate	0.01	Aliphatic ester
2-Methylbutyl acetate	0.01	Aliphatic ester
Heptanal	tr	Aliphatic aldehyde
α-Thujene	0.25	Monoterpene
α-Pinene	1.88	Monoterpene
Camphene	0.03	Monoterpene
α-Fenchene	0.01	Monoterpene
β-Pinene	0.48	Monoterpene
Sabinene	4.94	Monoterpene
6-Methyl-5-hepten-2-one	0.02	Aliphatic ketone
Methyl 2-hydroxy-3-methylvalerate	0.02	Aliphatic ester
Myrcene	2.26	Monoterpene
α-Phellandrene	0.02	Monoterpene
Octanal	0.09	Aliphatic aldehyde
Δ3-Carene	0.02	Monoterpene
α-Terpinene	0.12	Monoterpene
para-Cymene	0.19	Monoterpene
Limonene	2.75	Monoterpene
1,8-Cineole	32.28	Monoterpenic ether
(*Z*)-β-Ocimene	0.03	Monoterpene
(*E*)-β-Ocimene	0.06	Monoterpene
γ-Terpinene	0.27	Monoterpene
cis-Sabinene hydrate	0.45	Monoterpenic alcohol
cis-Linalool oxide (fur.)	0.01	Monoterpenic alcohol
Octanol	0.07	Aliphatic alcohol
Terpinolene	0.11	Monoterpene
6,7-Epoxymyrcene	0.04	Monoterpenic ether
trans-Sabinene hydrate	0.27	Monoterpenic alcohol
Linalool	3.14	Monoterpenic alcohol
cis-para-Menth-2-en-1-ol	0.03	Monoterpenic alcohol
(*E*)-4,8-Dimethylnona-1,3,7-triene	0.08	Terpene derivative
trans-para-Menth-2-en-1-ol	0.02	Monoterpenic alcohol
Borneol	0.01	Monoterpenic alcohol
δ-Terpineol	0.09	Monoterpenic alcohol
Terpinen-4-ol	0.68	Monoterpenic alcohol
para-Cymen-8-ol	0.02	Monoterpenic alcohol
α-Terpineol	1.27	Monoterpenic alcohol
cis-Piperitol	0.01	Monoterpenic alcohol
γ-Terpineol	0.07	Monoterpenic alcohol

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trans-Piperitol	0.01	Monoterpenic alcohol
Decanal	0.01	Aliphatic aldehyde
Octyl acetate	0.11	Aliphatic ester
trans-Carveol	0.01	Monoterpenic alcohol
cis-Sabinene hydrate acetate?	0.38	Monoterpenic ester
exo-2-Hydroxycineole	0.01	Monoterpenic alcohol
cis-Carveol	0.01	Monoterpenic alcohol
Neral	0.17	Monoterpenic aldehyde
Linalyl acetate	4.76	Monoterpenic ester
Geraniol	0.87	Monoterpenic alcohol
Geranial	0.25	Monoterpenic aldehyde
Bornyl acetate	0.03	Monoterpenic ester
Terpinen-4-yl acetate	0.02	Monoterpenic ester
Geranyl formate	0.02	Monoterpenic ester
δ-Terpinyl acetate	0.12	Monoterpenic ester
Methyl nerate?	0.02	Monoterpenic ester
Methyl geranate	0.09	Monoterpenic ester
δ-Elemene	0.02	Sesquiterpene
α-Terpinyl acetate	35.94	Monoterpenic ester
Neryl acetate	0.03	Monoterpenic ester
α-Copaene	0.02	Sesquiterpene
Geranyl acetate	0.77	Monoterpenic ester
β-Cubebene	0.02	Sesquiterpene
β-Elemene	0.05	Sesquiterpene
Dodecenyl acetate isomer?	0.09	Aliphatic ester
β-Caryophyllene	0.05	Sesquiterpene
α-Terpinyl propionate	0.07	Monoterpenic ester
Unknown	0.02	Sesquiterpene
Geranylacetone	0.02	Monoterpenic ketone
8-Acetoxy-*trans*-para-Menth-2-en-1-ol [2-(4-Hydroxy-4-methylcyclohex-2-enyl)propan-2-yl acetate]	0.02	Monoterpenic ester
Geranyl propionate	0.01	Monoterpenic ester
Germacrene D	0.06	Sesquiterpene
β-Selinene	0.30	Sesquiterpene
α-Selinene	0.11	Sesquiterpene
δ-Amorphene	0.02	Sesquiterpene
γ-Cadinene	0.12	Sesquiterpene
δ-Cadinene	0.03	Sesquiterpene
Germacrene B	0.07	Sesquiterpene
(*E*)-Nerolidol	0.78	Sesquiterpenic alcohol
(3*E*,7*E*)-4,8,12-Trimethyl-1,3,7,11-tridecatetraene	0.15	Terpene derivative
Unknown	0.02	Oxygenated sesquiterpene
Unknown	0.01	Unknown
Unknown	0.01	Unknown
Unknown	0.01	Oxygenated sesquiterpene
(2*E*,6*Z*)-Farnesal	0.03	Sesquiterpenic aldehyde
(2*E*,6*E*)-Farnesol	0.11	Sesquiterpenic alcohol
(2*E*,6*E*)-Farnesal	0.04	Sesquiterpenic aldehyde
γ-Bicyclohomofarnesal	0.05	Terpenic aldehyde
(2*E*,6*E*)-Farnesyl acetate	0.04	Sesquiterpenic ester
Coronarin *E*	0.16	Diterpene

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8-Acetoxycarvotanacetone	0.02	Monoterpenic ester
Consolidated total	**98.35%**	

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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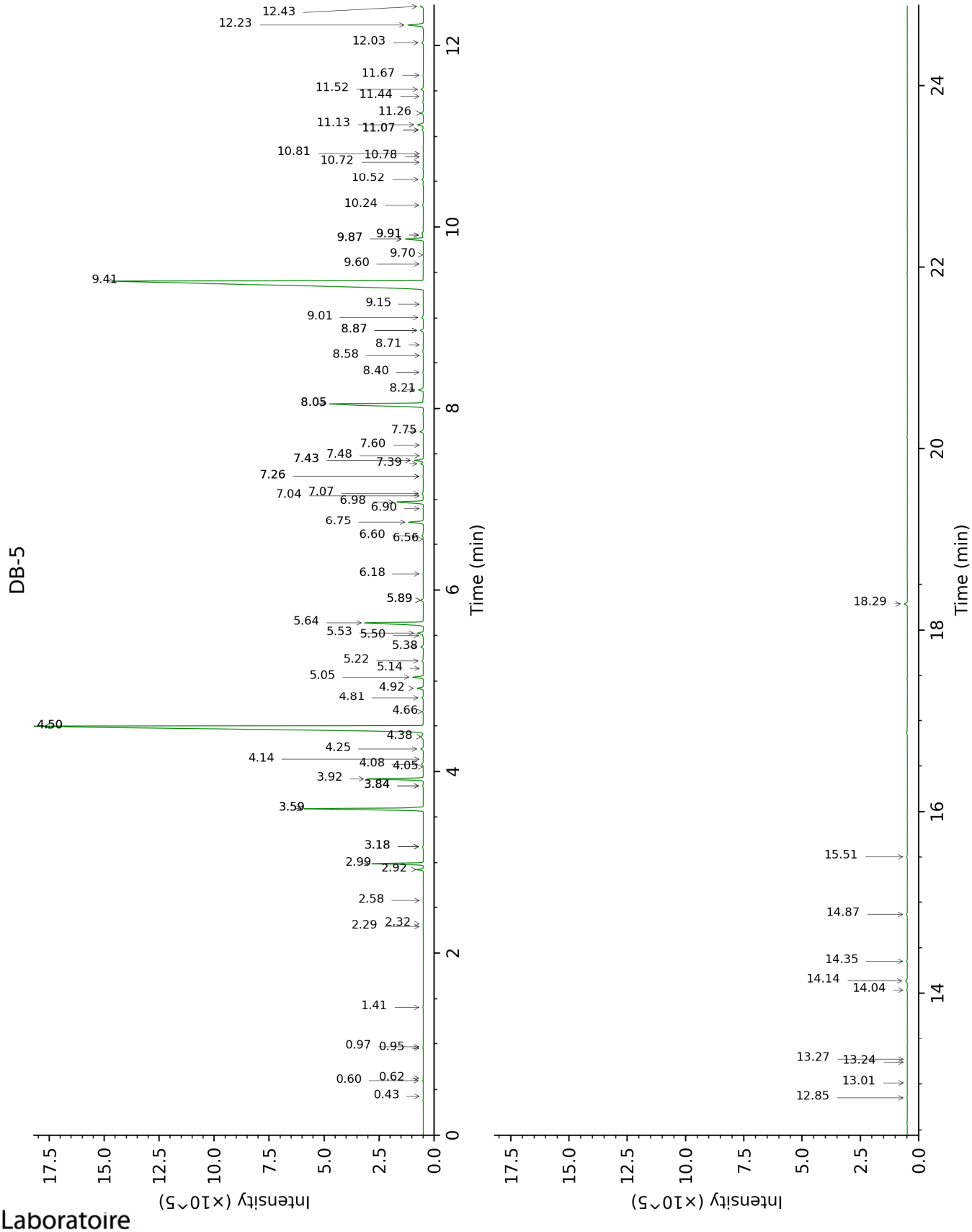
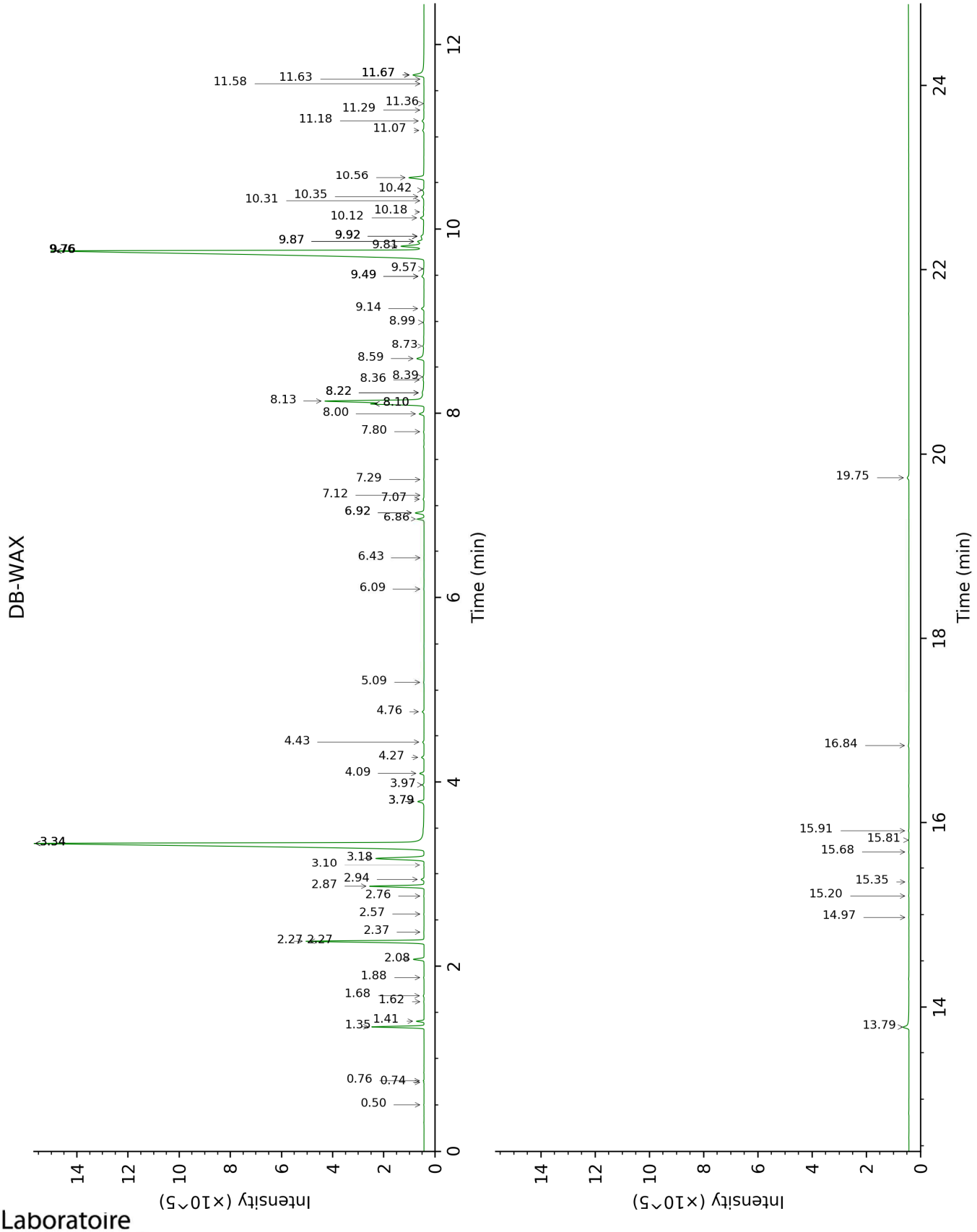

DB-5
Intensity (×10^5)
Time (min)
12.43
12.23
12.03
11.67
11.52
11.44
11.26
11.13
11.07
10.81
10.78
10.72
10.52
10.24
9.87
9.91
9.70
9.60
9.41
9.15
9.01
8.87
8.71
8.58
8.40
8.21
8.05
7.75
7.60
7.43
7.48
7.39
7.26
7.04
7.07
6.98
6.90
6.75
6.60
6.56
6.18
5.89
5.64
5.53
5.50
5.38
5.22
5.14
5.05
4.92
4.81
4.66
4.50
4.38
4.25
4.14
4.08
4.05
3.92
3.84
3.59
3.18
2.99
2.92
2.58
2.29
2.32
1.41
0.97
0.95
0.60
0.62
0.43
18.29
15.51
14.87
14.35
14.14
14.04
13.27
13.24
13.01
12.85


DB-WAX
Intensity (×10^5)
Time (min)
11.58
11.63
11.67
11.29
11.36
11.18
11.07
10.56
10.42
10.31
10.35
10.12
10.18
9.87
9.92
9.81
9.76
9.49
9.57
9.14
8.99
8.73
8.59
8.36
8.39
8.22
8.13
8.10
8.00
7.80
7.29
7.12
7.07
6.92
6.86
6.43
6.09
5.09
4.76
4.43
4.27
4.09
3.97
3.79
3.34
3.18
3.10
2.94
2.87
2.76
2.57
2.37
2.27
2.27
2.08
1.88
1.68
1.62
1.41
1.35
0.76
0.74
0.50
19.75
16.84
15.91
15.81
15.68
15.35
15.20
14.97
13.79

FULL ANALYSIS DATA

Identification	Column DB-5			Column DB-WAX		
	R.T	R.I	%	R.T	R.I	%
Isobutyral	0.43	534	tr	0.50	787	0.01
Isovaleral	0.60	641	0.02	0.76	889	0.02
2-Methylbutyral	0.62	652	0.01	0.74	882	0.01
Isoamyl alcohol	0.95	733	0.01	3.34*	1171	33.40
2-Methylbutanol	0.97	736	0.02	3.34*	1171	[33.40]
Hexanal	1.41	800	0.02	1.88	1045	0.02
Isoamyl acetate	2.29	878	0.01	2.37	1094	0.02
2-Methylbutyl acetate	2.32	880	0.01	2.27*	1085	5.20
Heptanal	2.58	902	tr	3.10	1152	0.01
α-Thujene	2.92	925	0.25	1.41†	997	[2.24]
α-Pinene	2.99	930	1.88	1.35†	990	2.24
Camphene	3.18*	942	0.04	1.68	1025	0.03
α-Fenchene	3.18*	942	[0.04]	1.62	1018	0.01
β-Pinene	3.59*	970	5.42	2.08	1065	0.48
Sabinene	3.59*	970	[5.42]	2.27*	1085	[5.20]
6-Methyl-5-hepten-2-one	3.84*	987	0.04	5.09	1299	0.02
Methyl 2-hydroxy-3-methylvalerate	3.84*	987	[0.04]			
Myrcene	3.92	992	2.26	2.87	1134	2.36
α-Phellandrene	4.05	1001	0.02	2.76	1125	0.01
Octanal	4.08	1003	0.09	4.43	1252	0.06
Δ3-Carene	4.14	1007	0.02	2.57	1110	0.01
α-Terpinene	4.25	1014	0.12	2.94	1139	0.13
para-Cymene	4.38	1022	0.19	4.09	1228	0.19
Limonene	4.50*	1030	35.03	3.18	1158	2.75
1,8-Cineole	4.50*	1030	[35.03]	3.34*	1171	[33.40]
(*Z*)-β-Ocimene	4.66	1040	0.03	3.79*	1206	0.31
(*E*)-β-Ocimene	4.81	1049	0.06	3.97	1219	0.06
γ-Terpinene	4.92	1056	0.27	3.79*	1206	[0.31]
cis-Sabinene hydrate	5.05	1064	0.45	6.92*	1432	0.48
cis-Linalool oxide (fur.)	5.14	1070	0.01	6.43	1396	0.01
Octanol	5.22	1076	0.07	8.22*	1530	0.24
Terpinolene	5.38	1085	0.11	4.27	1240	0.11
6,7-Epoxymyrcene	5.50	1093	0.04	6.09	1371	0.02
trans-Sabinene hydrate	5.53	1095	0.27	8.00	1512	0.26
Linalool	5.64	1102	3.14	8.10*†	1521	7.94
cis-para-Menth-2-en-1-ol	5.89*	1118	0.12	8.10*†	1521	[7.94]
(*E*)-4,8-Dimethylnona-1,3,7-triene	5.89*	1118	[0.12]	4.76	1276	0.08
trans-para-Menth-2-en-1-ol	6.18	1137	0.02	8.99	1589	0.03
Borneol	6.56	1161	0.01	9.76*†	1652	37.69
δ-Terpineol	6.60	1164	0.09	9.49*	1630	0.16
Terpinen-4-ol	6.75	1174	0.68	8.59	1559	0.56
para-Cymen-8-ol	6.90	1184	0.02	11.58	1804	0.01
α-Terpineol	6.98	1188	1.27	9.82†	1656	[37.69]
cis-Piperitol	7.04	1193	0.01	9.57	1636	0.02

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γ-Terpineol	7.07	1194	0.07	9.87*	1660	0.41
trans-Piperitol	7.26*	1207	0.04	10.31	1696	0.01
Decanal	7.26*	1207	[0.04]	7.28	1459	0.01
Octyl acetate	7.40	1216	0.11	7.07	1443	0.05
trans-Carveol	7.43*	1218	0.42	11.36	1785	0.01
cis-Sabinene hydrate acetate?	7.43*	1218	[0.42]	6.86	1427	0.38
exo-2-Hydroxycineole	7.48	1222	0.01	11.63	1808	tr
cis-Carveol	7.60	1230	0.01	11.67*	1812	0.90
Neral	7.75	1240	0.17	9.49*	1630	[0.16]
Linalyl acetate	8.05*	1261	6.30	8.13†	1523	[7.94]
Geraniol	8.05*	1261	[6.30]	11.67*	1812	[0.90]
Geranial	8.21	1271	0.25	10.12	1681	0.21
Bornyl acetate	8.40	1284	0.03	8.22*	1530	[0.24]
Terpinen-4-yl acetate	8.58	1297	0.02	8.73	1569	0.10
Geranyl formate	8.71	1305	0.02	9.92*	1664	0.34
δ-Terpinyl acetate	8.87*	1313	0.14	9.14	1602	0.12
Methyl nerate?	8.87*	1313	[0.14]			
Methyl geranate	9.01	1323	0.09	9.76*†	1652	[37.69]
δ-Elemene	9.15	1334	0.02	6.92*	1432	[0.48]
α-Terpinyl acetate	9.41	1352	35.94	9.76*†	1652	[37.69]
Neryl acetate	9.60	1365	0.03	10.18	1686	0.04
α-Copaene	9.70	1372	0.02	7.12	1446	0.01
Geranyl acetate	9.87*	1384	0.85	10.56	1717	0.77
β-Cubebene	9.87*	1384	[0.85]	7.80	1498	0.02
β-Elemene	9.91*†	1388	0.14	8.39†	1543	[0.10]
Dodecenyl acetate isomer?	9.91*†	1388	[0.14]			
β-Caryophyllene	10.24	1411	0.05	8.36†	1541	0.10
α-Terpinyl propionate	10.52	1432	0.07			
Unknown [m/z 43, 109 (35), 96 (23), 93 (22), 137 (21), 81 (20)...204 (5)]	10.72	1447	0.02			
Geranylacetone	10.78	1452	0.02	11.67*	1812	[0.90]
8-Acetoxy-*trans*-para-Menth-2-en-1-ol [2-(4-Hydroxy-4-methylcyclohex-2-enyl)propan-2-yl acetate]	10.81	1454	0.02	15.20	2141	0.02
Geranyl propionate	11.07*	1474	0.08	11.29	1779	0.01
Germacrene D	11.07*	1474	[0.08]	9.76*†	1652	[37.69]
β-Selinene	11.13	1478	0.30	9.87*	1660	[0.41]
α-Selinene	11.26	1487	0.11	9.92*	1664	[0.34]
δ-Amorphene	11.44	1501	0.02	9.92*	1664	[0.34]
γ-Cadinene	11.52	1507	0.12	10.35	1700	0.15
δ-Cadinene	11.67	1519	0.03	10.42	1706	0.07
Germacrene B	12.03	1548	0.07	11.07	1760	0.08
(*E*)-Nerolidol	12.23	1563	0.78	13.78	2003	0.50
(3*E*,7*E*)-4,8,12-Trimethyl-1,3,7,11-tridecatetraene	12.43	1579	0.15	11.18	1769	0.12

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Unknown [m/z 81, 43 (52), 161 (49), 105 (30), 207 (27), 95 (26), 93 (24), 109 (24)...]	12.85	1613	0.02	14.97	2118	0.01
Unknown [m/z 43, 71 (53), 108 (47), 126 (41), 109 (35), 93 (25)...]	13.01	1626	0.01			
Unknown [m/z 43, 135 (59), 94 (33), 59 (25), 137 (25), 93 (19)...]	13.24	1645	0.01			
Unknown [m/z 43, 81 (84), 41 (64), 67 (62), 95 (58), 79 (58)... 204 (48), 220 (2)]	13.27	1648	0.01			
(2*E*,6*Z*)-Farnesal	14.04	1711	0.03	15.35	2156	0.01
(2*E*,6*E*)-Farnesol	14.14	1720	0.11	16.84	2308	0.05
(2*E*,6*E*)-Farnesal	14.35	1739	0.04	15.81	2202	0.02
γ-Bicyclohomofarnesal	14.87	1784	0.05			
(2*E*,6*E*)-Farnesyl acetate	15.51	1841	0.04	15.91	2212	0.03
Coronarin *E*	18.29	2109	0.16	19.74	2634	0.11
8-Acetoxycarvotanacetone				15.68	2189	0.02
Total identified	**99.02%**			**99.66%**		
Total reported	**99.08%**			**99.68%**		

*: 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

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