Date : January 23, 2019

Certificate of Analysis – GC Profiling

Sample identification

Internal code : 19A10-ORA04-1-CC
Customer identification : Organic tea tree
Type : Essential oil
Source : *Melaleuca alternifolia* ct. Terpinen-4-ol
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 : Benoit Roger, Ph. D.
Analysis date : January 16, 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: 1.4765 ± 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
Ethanol	0.19	0.20	Aliphatic alcohol
Isobutyral	0.03	0.03	Aliphatic aldehyde
Ethyl acetate	0.01	0.01	Aliphatic ester
Isobutanol	tr	0.71*	Aliphatic alcohol
2-Methylbutyral	0.02	0.02	Aliphatic aldehyde
(3*Z*)-Hexenol	0.04	0.06	Aliphatic alcohol
α-Thujene	0.90	0.89	Monoterpene
α-Pinene	2.43	2.40	Monoterpene
Camphene	0.01*	0.01	Monoterpene
α-Fenchene	[0.01]*	tr	Monoterpene
Sabinene	0.96*	0.24	Monoterpene
β-Pinene	[0.96]*	[0.71]*	Monoterpene
Myrcene	0.84	0.83	Monoterpene
α-Phellandrene	0.47*	0.46	Monoterpene
Pseudolimonene	[0.47]*	0.01	Monoterpene
α-Terpinene	9.45	9.34	Monoterpene
para-Cymene	2.26	2.26	Monoterpene
Limonene	3.90*	0.84	Monoterpene
β-Phellandrene	[3.90]*	3.07*	Monoterpene
1,8-Cineole	[3.90]*	[3.07]*	Monoterpenic ether
(*Z*)-β-Ocimene	tr		Monoterpene
(*E*)-β-Ocimene	0.01	0.02	Monoterpene
γ-Terpinene	20.12	19.92	Monoterpene
cis-Sabinene hydrate	0.03	0.08*	Monoterpenic alcohol
para-Cymenene	3.39*	0.06	Monoterpene
Terpinolene isomer	[3.39]*	3.28	Monoterpene
trans-Sabinene hydrate	0.03	0.04	Monoterpenic alcohol
Linalool	0.07	0.06	Monoterpenic alcohol
Unknown	tr	0.34*	Monoterpenic alcohol
para-Mentha-1,3,8-triene	0.01	0.01*	Monoterpene
endo-Fenchol	0.01	0.02*	Monoterpenic alcohol
cis-para-Menth-2-en-1-ol	0.27	0.29	Monoterpenic alcohol
4-Hydroxy-4-methylcyclohex-2-enone	0.02	0.12*	Aliphatic alcohol
trans-Pinocarveol	0.01*	0.06*	Monoterpenic alcohol
Cosmene isomer I	[0.01]*	0.02	Monoterpene
Camphor	0.22*	0.10*	Monoterpenic ketone
Cosmene isomer II	[0.22]*	[0.01]*	Monoterpene
trans-para-Menth-2-en-1-ol	[0.22]*	0.12*	Monoterpenic alcohol
Unknown	0.02	0.06*	Unknown
δ-Terpineol	0.01	0.04*	Monoterpenic alcohol
Terpinen-4-ol	41.80*	43.03*	Monoterpenic alcohol
Dill ether	[41.80]*	0.01	Monoterpenic ether
para-Cymen-8-ol	0.09	0.05	Monoterpenic alcohol
α-Terpineol	3.00	3.03*	Monoterpenic alcohol
cis-Piperitol	0.07	0.07	Monoterpenic alcohol
trans-Piperitol	0.14	0.14*	Monoterpenic alcohol
exo-2-Hydroxycineole	0.01	0.01	Monoterpenic alcohol

cis-para-Mentha-1(7),8-dien-2-ol	0.03*	0.01	Monoterpenic alcohol
Nerol	[0.03]*	0.03	Monoterpenic alcohol
Piperitone	0.05	0.10*	Monoterpenic ketone
trans-Ascaridole glycol	0.05	0.06	Monoterpenic alcohol
cis-Ascaridole glycol?	0.03	0.05	Monoterpenic alcohol
Thymol	0.02	0.01	Monoterpenic alcohol
Carvacrol	0.01	0.01	Monoterpenic alcohol
Unknown	0.04	0.04	Monoterpenic alcohol
Bicycloelemene	0.02	0.02	Sesquiterpene
α-Cubebene	0.05	[0.06]*	Sesquiterpene
Cyclosativene I	tr	[0.08]*	Sesquiterpene
Unknown	0.02	0.02	Unknown
α-Copaene	0.05	0.04	Sesquiterpene
7-Cubebene	0.10	[0.10]*	Sesquiterpene
7-Cubebene epimer?	0.05	[0.10]*	Aliphatic alcohol
β-Elemene	0.02	0.03	Sesquiterpene
Methyleugenol	0.33*	0.16*	Phenylpropanoid
α-Gurjunene	[0.33]*	0.30	Sesquiterpene
β-Maaliene	0.01	0.03	Sesquiterpene
β-Caryophyllene	0.35	[0.34]*	Sesquiterpene
γ-Maaliene	0.07	0.08	Sesquiterpene
β-Gurjunene	0.02	[0.02]*	Sesquiterpene
α-Maaliene	0.06	[43.03]*	Sesquiterpene
Aromadendrene	0.90	[43.03]*	Sesquiterpene
Selina-5,11-diene	0.12	0.14	Sesquiterpene
Cadina-3,5-diene isomer I?	0.12		Sesquiterpene
trans-Muurola-3,5-diene	0.12	[0.12]*	Sesquiterpene
α-Humulene	0.10	0.08	Sesquiterpene
allo-Aromadendrene	0.50*	0.49	Sesquiterpene
Valerena-4,7(11)-diene	[0.50]*	0.24	Sesquiterpene
γ-Gurjunene	0.04	[0.06]*	Sesquiterpene
γ-Muurolene	0.30*	0.10*	Sesquiterpene
Selina-4,11-diene	[0.30]*	[0.04]*	Sesquiterpene
trans-Cadina-1(6),4-diene	[0.30]*	0.25	Sesquiterpene
Germacrene D	0.03	[3.03]*	Sesquiterpene
β-Selinene	0.09	0.15	Sesquiterpene
allo-Aromadendr-9-ene	0.09	0.10	Sesquiterpene
trans-Muurola-4(15),5-diene	0.08*	[0.10]*	Sesquiterpene
δ-Selinene	[0.08]*	[0.10]*	Sesquiterpene
α-Selinene	0.09	0.09	Sesquiterpene
Bicyclogermacrene	1.73*	0.92	Sesquiterpene
Viridiflorene	[1.73]*	0.89	Sesquiterpene
Epizonarene	[1.73]*	[0.10]*	Sesquiterpene
α-Muurolene	0.14	0.07	Sesquiterpene
γ-Cadinene	0.04	[0.14]*	Sesquiterpene
trans-Calamenene	0.08	0.10	Sesquiterpene
δ-Cadinene	1.32*	1.09	Sesquiterpene
Zonarene	[1.32]*	0.25	Sesquiterpene
trans-Cadina-1,4-diene	0.17	0.17	Sesquiterpene
α-Calacorene	0.02	0.02	Sesquiterpene
Epiglobulol?	0.05	[0.16]*	Sesquiterpenic alcohol
Eudesma-5,7(11)-diene	0.02	0.02	Sesquiterpene

Maaliol	0.06*	0.02	Sesquiterpenic alcohol
Unknown	[0.06]*	[0.16]*	Oxygenated sesquiterpene
Spathulenol	0.07	0.07	Sesquiterpenic alcohol
Globulol	0.23	0.21	Sesquiterpenic alcohol
Gleenol	0.02	0.03	Sesquiterpenic alcohol
Viridiflorol	0.12	[0.12]*	Sesquiterpenic alcohol
Cubeban-11-ol	0.09	0.15*	Sesquiterpenic alcohol
Eudesm-5-en-11-ol analog	0.08*	0.06	Sesquiterpenic alcohol
Ledol	[0.08]*	0.03	Sesquiterpenic alcohol
Rosifoliol	0.09	0.09	Sesquiterpenic alcohol
1-epi-Cubenol	0.14	0.13	Sesquiterpenic alcohol
Isospathulenol	0.06	0.05	Sesquiterpenic alcohol
Cubenol	0.08	[0.15]*	Sesquiterpenic alcohol
α-Muurolol	0.03	0.04	Sesquiterpenic alcohol
Total identified	**99.35%**	**99.38%**	

*: 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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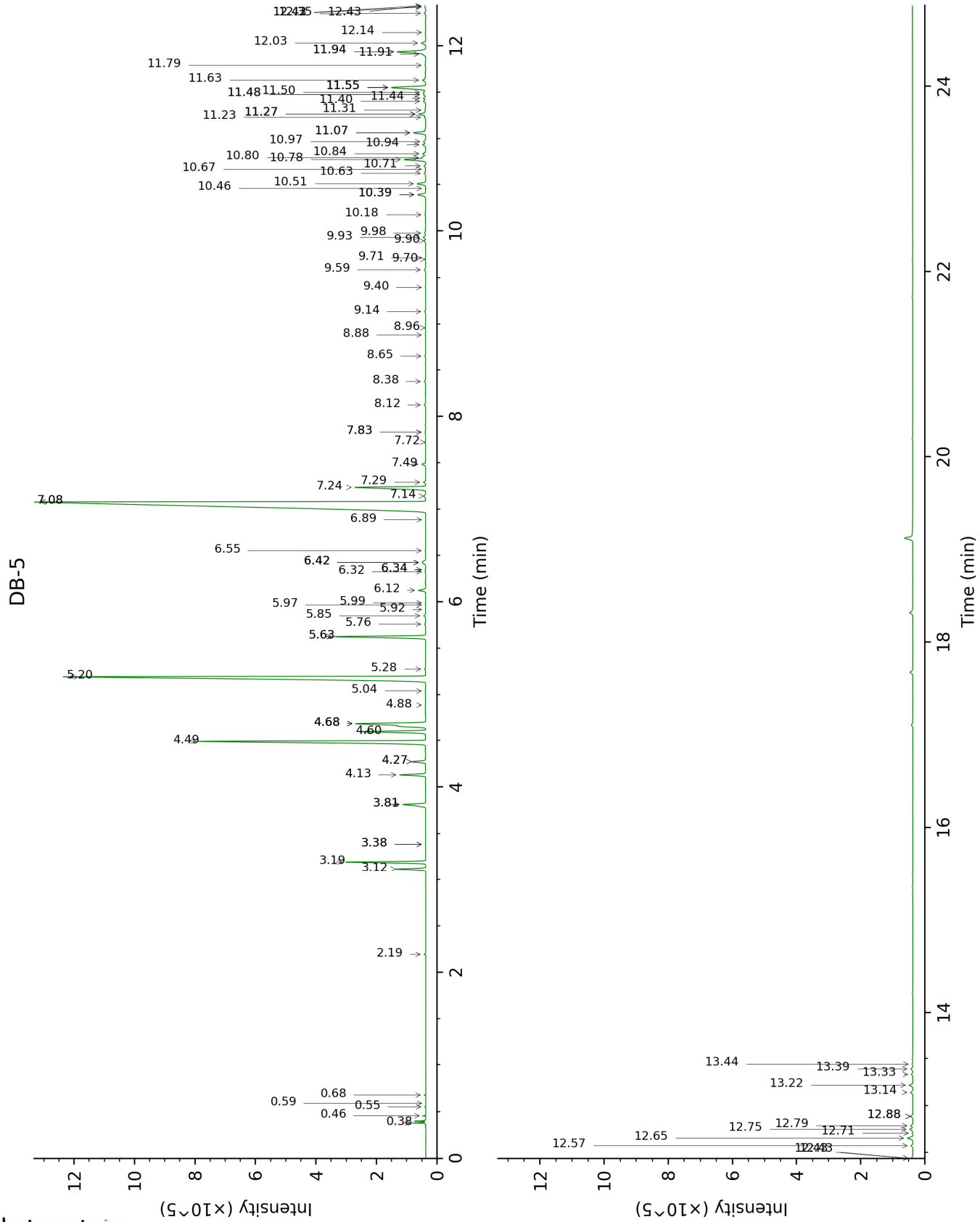
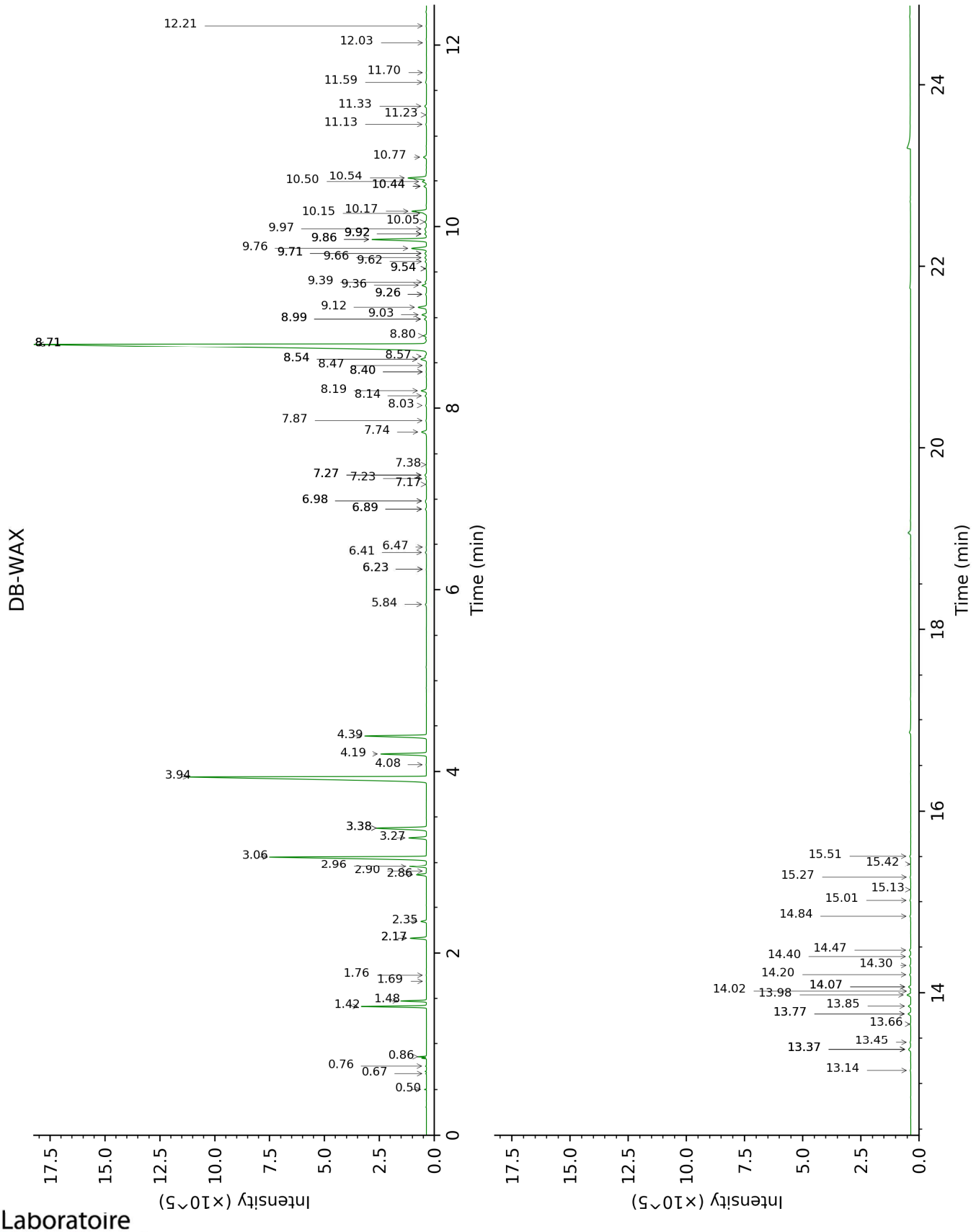

DB-5
Time (min)
Intensity (×10^5)
12.43
12.14
12.03
11.94
11.91
11.79
11.63
11.55
11.48
11.50
11.40
11.44
11.31
11.23
11.27
11.07
10.97
10.94
10.84
10.80
10.78
10.71
10.67
10.63
10.51
10.46
10.39
10.18
9.98
9.93
9.90
9.71
9.70
9.59
9.40
9.14
8.96
8.88
8.65
8.38
8.12
7.83
7.72
7.49
7.29
7.24
7.14
7.08
6.89
6.55
6.42
6.34
6.32
6.12
5.99
5.97
5.92
5.85
5.76
5.63
5.28
5.20
5.04
4.88
4.68
4.60
4.49
4.27
4.13
3.81
3.38
3.19
3.12
2.19
0.68
0.59
0.55
0.46
0.38
13.44
13.39
13.33
13.22
13.14
12.88
12.75
12.79
12.71
12.65
12.57
12.48
12.43


DB-WAX
Time (min)
Intensity (×10^5)
12.21
12.03
11.70
11.59
11.33
11.23
11.13
10.77
10.54
10.50
10.44
10.17
10.15
10.05
9.97
9.92
9.86
9.76
9.71
9.66
9.62
9.54
9.39
9.36
9.26
9.12
9.03
8.99
8.80
8.71
8.57
8.54
8.47
8.40
8.19
8.14
8.03
7.87
7.74
7.38
7.27
7.23
7.17
6.98
6.89
6.47
6.41
6.23
5.84
4.39
4.19
4.08
3.94
3.38
3.27
3.06
2.96
2.90
2.86
2.35
2.17
1.76
1.69
1.48
1.42
0.86
0.76
0.67
0.50
15.51
15.42
15.27
15.13
15.01
14.84
14.47
14.40
14.30
14.20
14.07
14.02
13.98
13.85
13.77
13.66
13.45
13.37
13.14

FULL ANALYSIS DATA

Identification	Column DB-5			Column DB-WAX		
	R.T	R.I	%	R.T	R.I	%
Ethanol	0.38	514	0.19	0.86	913	0.20
Isobutyral	0.46	551	0.03	0.50	783	0.03
Ethyl acetate	0.55	610	0.01	0.67	858	0.01
Isobutanol	0.59	622	tr	2.16*	1067	0.71
2-Methylbutyral	0.68	648	0.02	0.76	883	0.02
(3*Z*)-Hexenol	2.19	854	0.04	5.84	1346	0.06
α-Thujene	3.12	924	0.90	1.48	1003	0.89
α-Pinene	3.19	929	2.43	1.42	994	2.40
Camphene	3.38*	942	0.01	1.76	1029	0.01
α-Fenchene	3.38*	942	[0.01]	1.69	1023	tr
Sabinene	3.81*	970	0.96	2.35	1085	0.24
β-Pinene	3.81*	970	[0.96]	2.16*	1067	[0.71]
Myrcene	4.13	991	0.84	2.96	1135	0.83
α-Phellandrene	4.27*	1000	0.47	2.86	1128	0.46
Pseudolimonene	4.27*	1000	[0.47]	2.90	1131	0.01
α-Terpinene	4.49	1014	9.45	3.06	1144	9.34
para-Cymene	4.60	1021	2.26	4.19	1232	2.26
Limonene	4.68*	1026	3.90	3.27	1160	0.84
β-Phellandrene	4.68*	1026	[3.90]	3.38*	1169	3.07
1,8-Cineole	4.68*	1026	[3.90]	3.38*	1169	[3.07]
(*Z*)-β-Ocimene	4.88	1039	tr			
(*E*)-β-Ocimene	5.04	1049	0.01	4.08	1223	0.02
γ-Terpinene	5.20	1058	20.12	3.94	1213	19.92
cis-Sabinene hydrate	5.28	1064	0.03	6.98*	1430	0.08
para-Cymenene	5.63*	1086	3.39	6.41	1387	0.06
Terpinolene isomer	5.63*	1086	[3.39]	4.39	1247	3.28
trans-Sabinene hydrate	5.76	1094	0.03	8.03	1509	0.04
Linalool	5.85	1100	0.07	8.14	1517	0.06
Unknown [m/z 119, 109 (94), 43 (61), 95 (56), 91 (48), 77 (32), 152 (32), 137 (31), 134 (24)]	5.92	1104	tr	8.54*	1548	0.34
para-Mentha-1,3,8-triene	5.97	1107	0.01	6.23*	1374	0.01
endo-Fenchol	5.99	1109	0.01	8.40*	1538	0.02
cis-para-Menth-2-en-1-ol	6.12	1117	0.27	8.19	1522	0.29
4-Hydroxy-4-methylcyclohex-2-enone	6.32	1130	0.02	14.07*	2026	0.12
trans-Pinocarveol	6.34*	1132	0.01	9.26*	1605	0.06
Cosmene isomer I	6.34*	1132	[0.01]	6.47	1392	0.02
Camphor	6.42*	1137	0.22	7.27*	1451	0.10

Cosmene isomer II	6.42*	1137	[0.22]	6.23*	1374	[0.01]
trans-para-Menth-2-en-1-ol	6.42*	1137	[0.22]	8.99*	1584	0.12
Unknown [m/z 109, 124 (45), 119 (41), 43 (35), 91 (28), 95 (25)...]	6.55	1145	0.02	6.89*	1423	0.06
δ-Terpineol	6.89	1167	0.01	9.54*	1628	0.04
Terpinen-4-ol	7.08*	1179	41.80	8.71*	1562	43.03
Dill ether	7.08*	1179	[41.80]	7.38	1460	0.01
para-Cymen-8-ol	7.14	1184	0.09	11.59	1800	0.05
α-Terpineol	7.24	1190	3.00	9.86*	1654	3.03
cis-Piperitol	7.29	1193	0.07	9.62	1634	0.07
trans-Piperitol	7.49	1206	0.14	10.44*	1702	0.14
exo-2-Hydroxycineole	7.72	1222	0.01	11.70	1809	0.01
cis-para-Mentha-1(7),8-dien-2-ol	7.83*	1229	0.03	12.02	1838	0.01
Nerol	7.83*	1229	[0.03]	11.13	1760	0.03
Piperitone	8.12	1249	0.05	9.92*	1659	0.10
trans-Ascaridole glycol	8.38	1267	0.05	14.20	2039	0.06
cis-Ascaridole glycol?	8.65	1285	0.03	14.84	2102	0.05
Thymol	8.88	1302	0.02	15.13	2131	0.01
Carvacrol	8.96	1307	0.01	15.42	2160	0.01
Unknown [m/z 97, 112 (92), 83 (62), 43 (44), 41 (25)... 170? (4)]	9.14	1316	0.04	15.01	2119	0.04
Bicycloelemene	9.40	1334	0.02	7.17	1444	0.02
α-Cubebene	9.58	1348	0.05	6.89*	1423	[0.06]
Cyclosativene I	9.70	1355	tr	6.98*	1430	[0.08]
Unknown [m/z 43, 95 (62), 107 (45), 110 (41), 55 (28), 67 (25)...]	9.71	1356	0.02	14.02	2022	0.02
α-Copaene	9.90	1370	0.05	7.23	1448	0.04
7-Cubebene	9.93	1372	0.10	7.27*	1451	[0.10]
7-Cubebene epimer?	9.98	1376	0.05	7.27*	1451	[0.10]
β-Elemene	10.18	1390	0.02	8.47	1543	0.03
Methyleugenol	10.39*	1405	0.33	13.37*	1961	0.16
α-Gurjunene	10.39*	1405	[0.33]	7.74	1487	0.30
β-Maaliene	10.46	1410	0.01	7.86	1496	0.03
β-Caryophyllene	10.51	1414	0.35	8.54*	1548	[0.34]
γ-Maaliene	10.63	1423	0.07	8.57	1551	0.08
β-Gurjunene	10.67	1426	0.02	8.40*	1538	[0.02]
α-Maaliene	10.71	1429	0.06	8.71*	1562	[43.03]
Aromadendrene	10.78	1434	0.90	8.71*	1562	[43.03]
Selina-5,11-diene	10.80	1435	0.12	8.80	1569	0.14
Cadina-3,5-diene	10.84	1438	0.12			

isomer I?						
trans-Muurola-3,5-diene	10.94	1446	0.12	8.99*	1584	[0.12]
α-Humulene	10.97	1448	0.10	9.39	1616	0.08
allo-Aromadendrene	11.07*	1455	0.50	9.12	1594	0.49
Valerena-4,7(11)-diene	11.07*	1455	[0.50]	9.03	1587	0.24
γ-Gurjunene	11.23	1468	0.04	9.26*	1605	[0.06]
γ-Muurolene	11.27*	1470	0.30	9.71*	1642	0.10
Selina-4,11-diene	11.27*	1470	[0.30]	9.54*	1628	[0.04]
trans-Cadina-1(6),4-diene	11.27*	1470	[0.30]	9.36	1613	0.25
Germacrene D	11.31	1473	0.03	9.86*	1654	[3.03]
β-Selinene	11.40	1481	0.09	9.98	1664	0.15
allo-Aromadendr-9-ene	11.44	1483	0.09	9.66	1638	0.10
trans-Muurola-4(15),5-diene	11.48*	1486	0.08	9.92*	1659	[0.10]
δ-Selinene	11.48*	1486	[0.08]	9.71*	1642	[0.10]
α-Selinene	11.50	1488	0.09	10.05	1670	0.09
Bicyclogermacrene	11.55*	1492	1.73	10.17	1679	0.92
Viridiflorene	11.55*	1492	[1.73]	9.76	1646	0.89
Epizonarene	11.55*	1492	[1.73]	9.92*	1659	[0.10]
α-Muurolene	11.63	1498	0.14	10.15	1678	0.07
γ-Cadinene	11.79	1510	0.04	10.44*	1702	[0.14]
trans-Calamenene	11.91	1519	0.08	11.33	1778	0.10
δ-Cadinene	11.94*	1521	1.32	10.54	1710	1.09
Zonarene	11.94*	1521	[1.32]	10.50	1706	0.25
trans-Cadina-1,4-diene	12.03	1529	0.17	10.77	1730	0.17
α-Calacorene	12.14	1538	0.02	12.21	1855	0.02
Epiglobulol?	12.35	1554	0.05	13.37*	1961	[0.16]
Eudesma-5,7(11)-diene	12.42	1559	0.02	11.23	1769	0.02
Maaliol	12.43*	1560	0.06	13.14	1940	0.02
Unknown [m/z 161, 109 (98), 82 (93), 43 (72), 105 (68), 93 (59), 69 (56), 119 (55)... 222 (7)]	12.43*	1560	[0.06]	13.37*	1961	[0.16]
Spathulenol	12.57	1571	0.07	14.47	2066	0.07
Globulol	12.65	1578	0.23	13.98	2018	0.21
Gleenol	12.71	1582	0.02	13.66	1988	0.03
Viridiflorol	12.75	1585	0.12	14.07*	2026	[0.12]
Cubeban-11-ol	12.79	1588	0.09	13.77*	1998	0.15
Eudesm-5-en-11-ol analog	12.88*	1596	0.08	14.30	2049	0.06
Ledol	12.88*	1596	[0.08]	13.45	1968	0.03
Rosifoliol	13.14	1617	0.09	14.40	2059	0.09
1-epi-Cubenol	13.22	1623	0.14	13.85	2006	0.13

Isospathulenol	13.33	1633	0.06	15.51	2168	0.05
Cubenol	13.39	1638	0.08	13.77*	1998	[0.15]
α-Muurolol	13.44	1642	0.03	15.27	2145	0.04
Total identified		**99.35%**			**99.38%**	
Total reported		**99.43%**			**99.45%**	

*: 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
R.T.: Retention time (minutes)
R.I.: Retention index

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