Date : June 21, 2021

CERTIFICATE OF ANALYSIS – GC PROFILING

SAMPLE IDENTIFICATION

Internal code : 21F10-PTH02
Customer identification : Rosemary ORGANIC - Tunisia - R50110213R
Type : Essential oil
Source : *Rosmarinus officinalis* ct. 1,8-Cineole
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 : Sarah-Eve Tremblay, M. Sc. A., Chimiste
Analysis date : June 21, 2021

Checked and approved by :

Sylvain Mercier, M. Sc., chimiste 2014-005

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Physicochemical data

Physical aspect: Faintly yellow liquid
Refractive index: 1.4676 ± 0.0003 (20 °C; method PC-MAT-016)

ISO 1342:2001 - Oil of rosemary - Morocco & Tunisia

Compound	Min. %	Max. %	Observed %	Complies?
α-Pinene	9	14	11	Yes
Camphene	2.5	6.0	4.6	Yes
β-Pinene	4	9	8	Yes
Myrcene	1.0	2.0	1.3	Yes
Limonene	1.5	4.0	2.2	Yes
1,8-Cineole	38	55	42	Yes
para-Cymene	0.5	2.5	1.1	Yes
Camphor	5	15	11	Yes
Bornyl acetate	0.1	1.6	1.2	Yes
α-Terpineol	1.0	2.5	1.6	Yes
Borneol	1	5	3	Yes
Verbenone		0.4	0	Yes
Refractive index	1.4640	1.4700	1.4676	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
Isovaleral	tr	Aliphatic aldehyde
2-Methylbutyral	tr	Aliphatic aldehyde
2-Ethylfuran	tr	Furan
Isoamyl alcohol	0.01	Aliphatic alcohol
2-Methylbutanol	tr	Aliphatic alcohol
Toluene	tr	Simple phenolic
Hexanal	tr	Aliphatic aldehyde
(2*E*)-Hexenal	tr	Aliphatic aldehyde
(3*Z*)-Hexenol	0.02	Aliphatic alcohol
Hexanol	0.01	Aliphatic alcohol
Bornylene	tr	Monoterpene
Hashishene	0.02	Monoterpene
Tricyclene	0.16	Monoterpene
α-Thujene	0.38	Monoterpene
α-Pinene	10.90	Monoterpene
Camphene	4.61	Monoterpene
α-Fenchene	0.06	Monoterpene
Thuja-2,4(10)-diene	tr	Monoterpene
β-Pinene	8.16	Monoterpene
Sabinene	0.17	Monoterpene
Octen-3-ol	0.03	Aliphatic alcohol
Octan-3-one	0.10	Aliphatic ketone
Dehydro-1,8-cineole	0.06	Monoterpenic ether
Myrcene	1.33	Monoterpene
Octan-3-ol	tr	Aliphatic alcohol
Pseudolimonene	0.03	Monoterpene
α-Phellandrene	0.14	Monoterpene
Δ3-Carene	0.29	Monoterpene
α-Terpinene	0.42	Monoterpene
para-Cymene	1.09	Monoterpene
Limonene	2.20	Monoterpene
1,8-Cineole	42.29	Monoterpenic ether
(*Z*)-β-Ocimene	0.07	Monoterpene
(*E*)-β-Ocimene	0.07	Monoterpene
γ-Terpinene	0.75	Monoterpene
cis-Sabinene hydrate	0.11	Monoterpenic alcohol
cis-Linalool oxide (fur.)	tr	Monoterpenic alcohol
Octanol	0.01	Aliphatic alcohol
Fenchone	0.01	Monoterpenic ketone
Terpinolene	0.39	Monoterpene
para-Cymenene	0.03	Monoterpene
trans-Sabinene hydrate	0.05	Monoterpenic alcohol
Linalool	0.70	Monoterpenic alcohol
Unknown	0.01	Unknown
Hotrienol	0.01	Monoterpenic alcohol

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endo-Fenchol	0.03	Monoterpenic alcohol
trans-para-Mentha-2,8-dien-1-ol	0.01	Monoterpenic alcohol
cis-para-Menth-2-en-1-ol	0.03	Monoterpenic alcohol
α-Campholenal	0.02	Monoterpenic aldehyde
cis-Limonene oxide	tr	Monoterpenic ether
trans-Pinocarveol	tr	Monoterpenic alcohol
Camphor	10.88	Monoterpenic ketone
Camphene hydrate	0.06	Monoterpenic alcohol
Isoborneol	0.02	Monoterpenic alcohol
Pinocarvone	0.02	Monoterpenic ketone
Borneol	3.22	Monoterpenic alcohol
δ-Terpineol	0.34	Monoterpenic alcohol
Isopinocamphone	0.02	Monoterpenic ketone
Terpinen-4-ol	0.78	Monoterpenic alcohol
para-Cymen-8-ol	0.02	Monoterpenic alcohol
α-Terpineol	1.62	Monoterpenic alcohol
Myrtenal	0.02	Monoterpenic aldehyde
Myrtenol	0.02	Monoterpenic alcohol
Verbenone	0.01	Monoterpenic ketone
trans-Carveol	tr	Monoterpenic alcohol
Bornyl formate	0.01	Monoterpenic ester
Citronellol	0.01	Monoterpenic alcohol
Piperitone	tr	Monoterpenic ketone
Linalyl acetate	0.01	Monoterpenic ester
Isopiperitenone	0.02	Monoterpenic ketone
Unknown	0.01	Unknown
Bornyl acetate	1.21	Monoterpenic ester
Unknown	tr	Oxygenated monoterpene
cis-para-Mentha-2,8-diene-1-hydroperoxide?	0.01	Monoterpenic peroxide
Unknown	tr	Unknown
Limonene hydroperoxide I	tr	Monoterpenic peroxide
Unknown	0.01	Monoterpenic alcohol
para-Mentha-1,8-diene-4-hydroperoxide	tr	Monoterpenic peroxide
Unknown	tr	Unknown
α-Cubebene	0.03	Sesquiterpene
α-Terpinyl acetate	0.02	Monoterpenic ester
Eugenol	0.01	Phenylpropanoid
α-Ylangene	0.06	Sesquiterpene
α-Copaene	0.21	Sesquiterpene
Unknown	0.01	Unknown
cis-para-Mentha-6,8-diene-2-hydroperoxide	0.01	Monoterpenic peroxide
Isolongifolene	0.01	Sesquiterpene
Isocaryophyllene	0.02	Sesquiterpene
Methyleugenol	0.04	Phenylpropanoid
β-Caryophyllene	3.86	Sesquiterpene
β-Copaene	0.07	Sesquiterpene
Aromadendrene	0.05	Sesquiterpene
trans-α-Bergamotene	0.01	Sesquiterpene
α-Humulene	0.44	Sesquiterpene
allo-Aromadendrene	0.01	Sesquiterpene
(*E*)-β-Farnesene	0.01	Sesquiterpene
trans-Cadina-1(6),4-diene	0.02	Sesquiterpene

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γ-Muurolene	0.19	Sesquiterpene
α-Amorphene	0.02	Sesquiterpene
β-Selinene	0.03	Sesquiterpene
α-Selinene	0.04	Sesquiterpene
Unknown	0.04	Unknown
α-Muurolene	0.06	Sesquiterpene
γ-Cadinene	0.11	Sesquiterpene
β-Bisabolene	0.05	Sesquiterpene
trans-Calamenene	0.02	Sesquiterpene
δ-Cadinene	0.25	Sesquiterpene
trans-Cadina-1,4-diene	0.02	Sesquiterpene
α-Calacorene	0.01	Sesquiterpene
Isocaryophyllene epoxide B	0.02	Sesquiterpenic ether
Caryophyllene oxide	0.13	Sesquiterpenic ether
Humulene epoxide II	0.01	Sesquiterpenic ether
Unknown	tr	Oxygenated sesquiterpene
Caryophylladienol I	tr	Sesquiterpenic alcohol
Caryophylladienol II	0.01	Sesquiterpenic alcohol
14-Hydroxy-(*Z*)-caryophyllene	0.01	Sesquiterpenic alcohol
(3*Z*)-Caryophylla-3,8(13)-dien-5β-ol	0.01	Sesquiterpenic alcohol
Unknown	tr	Oxygenated sesquiterpene
para-Camphorene	tr	Diterpene
Consolidated total	**99.04%**	

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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This page was intentionally left blank. The following pages present the complete data of the analysis.

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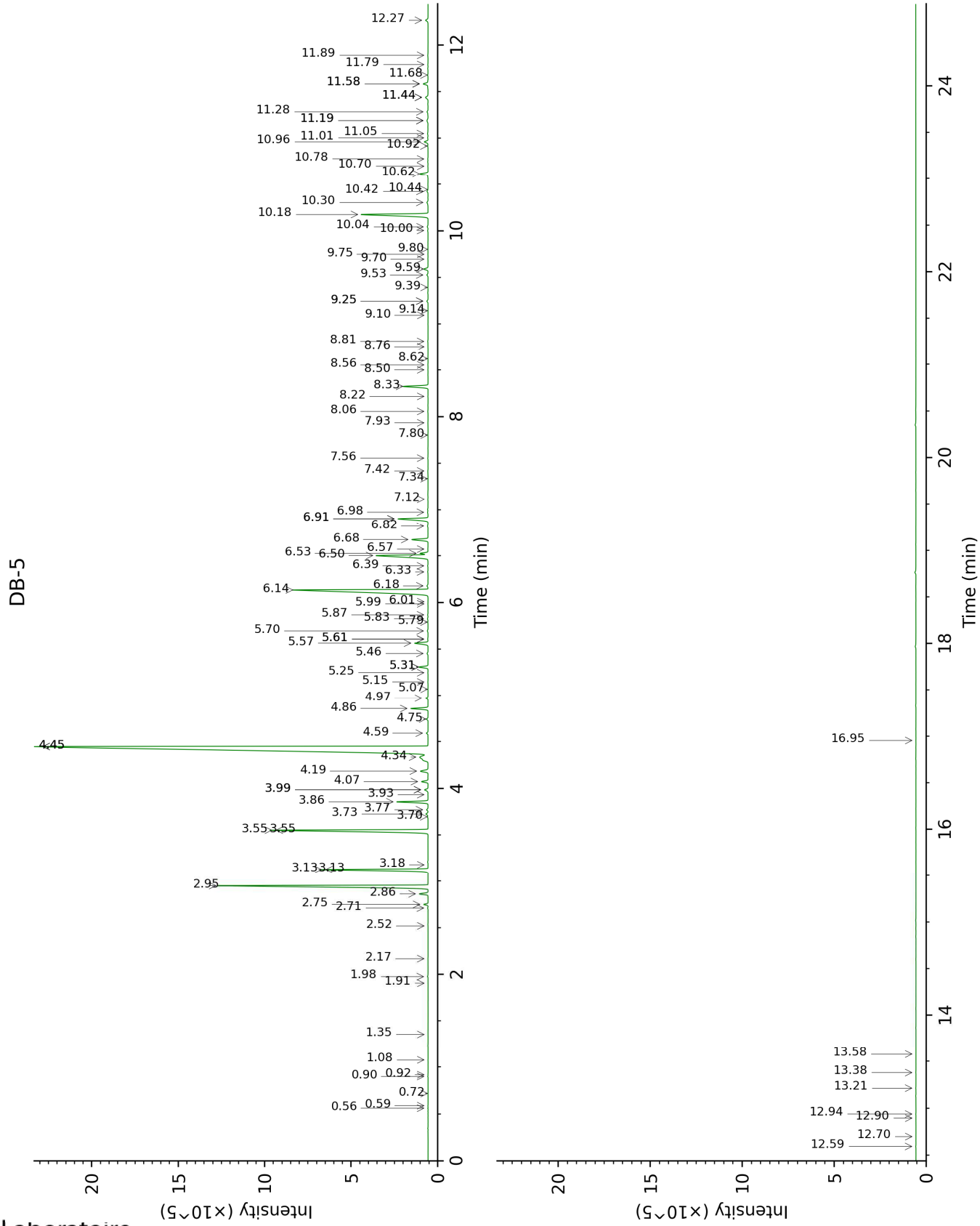
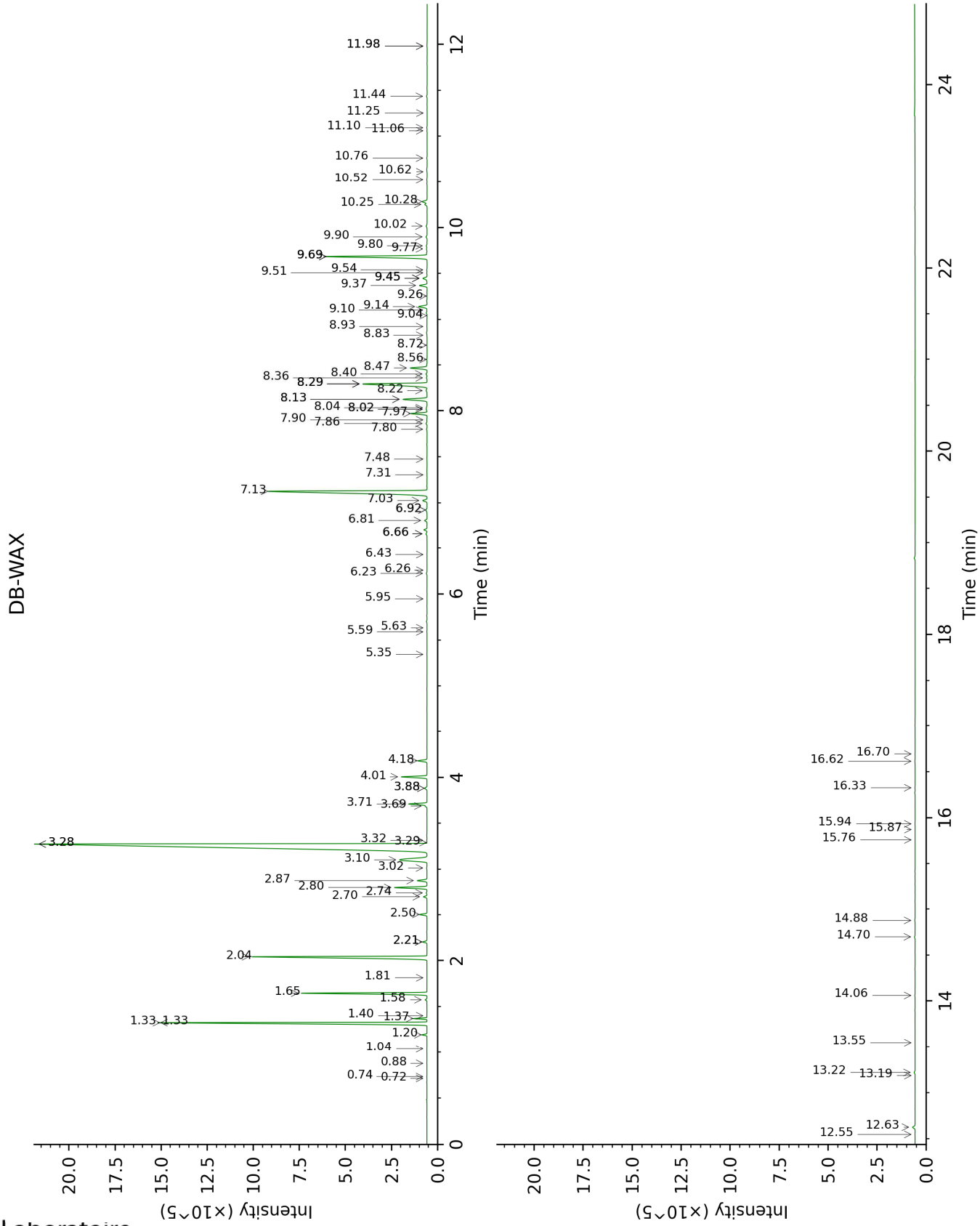

DB-5
Intensity (×10^5)
Time (min)
12.27
11.89
11.79
11.68
11.58
11.44
11.28
11.19
11.05
10.96
11.01
10.92
10.78
10.70
10.62
10.42
10.44
10.30
10.18
10.04
10.00
9.80
9.75
9.70
9.59
9.53
9.39
9.25
9.14
9.10
8.81
8.76
8.62
8.56
8.50
8.33
8.22
8.06
7.93
7.80
7.56
7.42
7.34
7.12
6.98
6.91
6.82
6.68
6.57
6.53
6.50
6.39
6.33
6.18
6.14
6.01
5.99
5.87
5.83
5.79
5.70
5.61
5.57
5.46
5.31
5.25
5.15
5.07
4.97
4.86
4.75
4.59
4.45
4.34
4.19
4.07
3.99
3.93
3.86
3.77
3.73
3.70
3.55
3.55
3.18
3.13
3.13
2.95
2.86
2.75
2.71
2.52
2.17
1.98
1.91
1.35
1.08
0.90
0.92
0.72
0.56
0.59
16.95
13.58
13.38
13.21
12.94
12.90
12.70
12.59


DB-WAX
Intensity (×10^5)
Time (min)
11.98
11.44
11.25
11.10
11.06
10.76
10.62
10.52
10.25
10.28
10.02
9.90
9.80
9.77
9.69
9.51
9.54
9.45
9.37
9.26
9.10
9.14
9.04
8.93
8.83
8.72
8.56
8.47
8.40
8.36
8.29
8.22
8.13
8.04
8.02
7.97
7.90
7.86
7.80
7.48
7.31
7.13
7.03
6.92
6.81
6.66
6.43
6.26
6.23
5.95
5.63
5.59
5.35
4.18
4.01
3.88
3.71
3.69
3.32
3.29
3.28
3.10
3.02
2.87
2.80
2.74
2.70
2.50
2.21
2.04
1.81
1.65
1.58
1.40
1.37
1.33
1.33
1.20
1.04
0.88
0.74
0.72
16.70
16.62
16.33
15.94
15.87
15.76
14.88
14.70
14.06
13.55
13.22
13.19
12.63
12.55

FULL ANALYSIS DATA

Identification	Column DB-5			Column DB-WAX		
	R.T	R.I	%	R.T	R.I	%
Isovaleral	0.56	643	tr	0.74	889	0.01
2-Methylbutyral	0.59	653	tr	0.72	881	tr
2-Ethylfuran	0.72	702	tr	0.88	917	tr
Isoamyl alcohol	0.90	731	0.01	3.32	1177	0.01
2-Methylbutanol	0.92	734	tr	3.29	1175	tr
Toluene	1.08	758	tr	1.40	1002	tr
Hexanal	1.36	800	tr	1.82	1045	tr
(2*E*)-Hexenal	1.90	849	tr	3.28*	1174	42.39
(3*Z*)-Hexenol	1.98	855	0.02	5.64	1346	tr
Hexanol	2.17	872	0.01	5.35	1325	0.01
Bornylene	2.52	902	tr	1.04	944	tr
Hashishene	2.71	916	0.02	1.33*	994	10.80
Tricyclene	2.75	918	0.16	1.20	972	0.16
α-Thujene	2.86	926	0.38	1.37	999	0.38
α-Pinene	2.95	932	10.90	1.33*	994	[10.80]
Camphene	3.13*	944	4.70	1.65	1028	4.61
α-Fenchene	3.13*	944	[4.70]	1.58	1020	0.06
Thuja-2,4(10)-diene	3.18	947	tr	2.20*	1085	0.17
β-Pinene	3.55*	973	8.42	2.04	1068	8.16
Sabinene	3.55*	973	[8.42]	2.20*	1085	[0.17]
Octen-3-ol	3.70	982	0.03	6.66*	1421	0.06
Octan-3-one	3.73	984	0.10	3.88*	1221	0.12
Dehydro-1,8-cineole	3.77	988	0.06	3.02	1152	0.01
Myrcene	3.86	993	1.33	2.80	1135	1.32
Octan-3-ol	3.93	998	tr	5.95	1369	tr
Pseudolimonene	3.99*	1002	0.18	2.74	1130	0.03
α-Phellandrene	3.99*	1002	[0.18]	2.70	1127	0.14
Δ3-Carene	4.07	1008	0.29	2.50	1111	0.29
α-Terpinene	4.19	1015	0.42	2.87	1141	0.41
para-Cymene	4.34	1024	1.09	4.01	1230	1.07
Limonene	4.45*	1032	44.48	3.10	1160	2.20
1,8-Cineole	4.45*	1032	[44.48]	3.28*	1174	[42.39]
(*Z*)-β-Ocimene	4.59	1041	0.07	3.69	1206	0.06
(*E*)-β-Ocimene	4.74	1050	0.07	3.88*	1221	[0.12]
γ-Terpinene	4.86	1058	0.75	3.71	1208	0.76
cis-Sabinene hydrate	4.97	1065	0.11	6.81	1432	0.11
cis-Linalool oxide (fur.)	5.07	1071	tr	6.43	1404	tr
Octanol	5.15	1076	0.01	8.04	1524	0.02
Fenchone	5.25	1083	0.01	5.59	1343	0.01
Terpinolene	5.31*	1086	0.42	4.18	1243	0.39
para-Cymenene	5.31*	1086	[0.42]	6.23	1389	0.03
trans-Sabinene hydrate	5.46	1096	0.05	7.86	1511	0.05
Linalool	5.57	1103	0.70	7.97	1519	0.71

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Unknown [m/z 139, 95 (95), 109 (64), 121 (40), 41 (23), 136 (22)...]	5.61*	1106	0.02			
Hotrienol	5.61*	1106	[0.02]	8.72	1578	0.01
endo-Fenchol	5.70	1111	0.03	8.22	1539	0.06
trans-para-Mentha-2,8-dien-1-ol	5.79	1118	0.01	8.83	1586	0.01
cis-para-Menth-2-en-1-ol	5.83	1120	0.03	8.02*	1523	0.05
α-Campholenal	5.87	1122	0.02	6.92*	1440	0.08
cis-Limonene oxide	5.99	1130	tr	6.26	1391	tr
trans-Pinocarveol	6.01	1132	tr	9.04	1603	tr
Camphor	6.14	1140	10.88	7.13	1456	10.94
Camphene hydrate	6.18	1143	0.06	8.36	1549	0.03
Isoborneol	6.33	1152	0.02	9.26	1620	tr
Pinocarvone	6.39	1157	0.02	7.80	1506	0.02
Borneol	6.50	1164	3.22	9.69*	1655	4.87
δ-Terpineol	6.53	1165	0.34	9.37	1629	0.35
Isopinocamphone	6.57	1168	0.02	7.48	1482	0.01
Terpinen-4-ol	6.68	1175	0.78	8.47	1558	0.78
para-Cymen-8-ol	6.82	1184	0.02	11.44	1801	0.03
α-Terpineol	6.90*	1190	1.63	9.69*	1655	[4.87]
Myrtenal	6.90*	1190	[1.63]	8.56	1565	0.02
Myrtenol	6.98	1194	0.02	10.76	1744	0.02
Verbenone	7.12	1204	0.01	9.51	1640	0.02
trans-Carveol	7.34	1218	tr	11.25	1786	tr
Bornyl formate	7.42	1224	0.01	7.90	1514	0.01
Citronellol	7.56	1234	0.01	10.62	1732	0.01
Piperitone	7.80	1250	tr	9.77	1662	0.04
Linalyl acetate	7.94	1259	0.01	8.02*	1523	[0.05]
Isopiperitenone	8.06	1268	0.02	11.06	1769	0.01
Unknown [m/z 43, 79 (78), 128 (46), 58 (42), 127 (42)...]	8.22	1279	0.01	12.55	1900	0.01
Bornyl acetate	8.33	1286	1.21	8.13*	1531	1.23
Unknown [m/z 43, 93 (66), 91 (44), 41 (38), 69 (35)... 152? (1)]	8.50	1298	tr			
cis-para-Mentha-2,8-diene-1-hydroperoxide?	8.56	1302	0.01			
Unknown [m/z 69, 41 (79), 91 (56), 92 (54), 79 (50), 77 (35)...]	8.62	1306	tr			

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Limonene hydroperoxide I	8.76	1312	tr			
Unknown [m/z 97, 112 (92), 83 (62), 43 (44), 41 (25)... 170? (4)]	8.82	1316	0.01	14.88	2120	0.02
para-Mentha-1,8-diene-4-hydroperoxide	9.10	1336	tr			
Unknown [m/z 133, 105 (45), 91 (38), 119 (36)... 150 (3)]	9.14	1340	tr			
α-Cubebene	9.25*	1347	0.05	6.66*	1421	[0.06]
α-Terpinyl acetate	9.25*	1347	[0.05]	9.54	1643	0.02
Eugenol	9.39	1358	0.01	14.70	2102	0.03
α-Ylangene	9.53	1367	0.06	6.92*	1440	[0.08]
α-Copaene	9.59	1372	0.21	7.03	1448	0.21
Unknown [m/z 43, 41 (25), 67 (24), 109 (23), 93 (20), 69 (19)...]	9.70	1379	0.01	13.55	1992	tr
cis-para-Mentha-6,8-diene-2-hydroperoxide	9.75	1383	0.01			
Isolongifolene	9.80	1387	0.01	7.31	1469	0.01
Isocaryophyllene	10.00	1401	0.02	8.13*	1531	[1.23]
Methyleugenol	10.04	1404	0.04	13.22	1962	0.04
β-Caryophyllene	10.18	1414	3.86	8.29*	1544	3.89
β-Copaene	10.30	1423	0.07	8.29*	1544	[3.89]
Aromadendrene	10.42	1432	0.05	8.40	1553	0.05
trans-α-Bergamotene	10.44	1434	0.01	8.29*	1544	[3.89]
α-Humulene	10.62	1447	0.44	9.14	1611	0.43
allo-Aromadendrene	10.70	1453	0.01	8.93	1593	0.01
(*E*)-β-Farnesene	10.78	1459	0.01	9.45*	1636	0.23
trans-Cadina-1(6),4-diene	10.92	1469	0.02	9.10	1608	0.01
γ-Muurolene	10.96	1472	0.19	9.45*	1636	[0.23]
α-Amorphene	11.00	1476	0.02	9.45*	1636	[0.23]
β-Selinene	11.05	1479	0.03	9.69*	1655	[4.87]
α-Selinene	11.19*	1490	0.09	9.80	1664	0.04
Unknown [m/z 59, 94 (67), 95 (50), 79 (44), 43 (41), 73 (16)...]	11.19*	1490	[0.09]			
α-Muurolene	11.28	1497	0.06	9.90	1672	0.06
γ-Cadinene	11.44*	1508	0.17	10.25	1701	0.11
β-Bisabolene	11.44*	1508	[0.17]	10.02	1682	0.05
trans-Calamenene	11.58*	1520	0.27	11.10	1772	0.02
δ-Cadinene	11.58*	1520	[0.27]	10.28	1704	0.25

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trans-Cadina-1,4-diene	11.68	1527	0.02	10.52	1724	0.02
α-Calacorene	11.79	1536	0.01	11.98*	1850	0.03
Isocaryophyllene epoxide B	11.89	1544	0.02	11.98*	1850	[0.03]
Caryophyllene oxide	12.26	1574	0.13	12.63	1907	0.13
Humulene epoxide II	12.59	1600	0.01	13.19	1958	tr
Unknown [m/z 94, 91 (83), 105 (78), 79 (75), 107 (62), 120 (58)... 218 (11)]	12.70	1608	tr	14.06	2041	0.01
Caryophylladienol I	12.90	1624	tr	15.87	2220	tr
Caryophylladienol II	12.94	1628	0.01	15.94	2227	0.01
14-Hydroxy-(*Z*)-caryophyllene	13.22	1651	0.01	16.33	2267	0.01
(3*Z*)-Caryophylla-3,8(13)-dien-5β-ol	13.38	1665	0.01	16.70	2306	0.01
Unknown [m/z 43, 108 (62), 93 (51), 41 (42), 109 (37), 69 (36)...]	13.58	1681	tr	16.62	2298	0.02
para-Camphorene	16.95	1986	tr	15.76	2209	tr
Total identified		**99.14%**			**98.82%**	
Total reported		**99.19%**			**98.88%**	

*: Two or more compounds are coeluting on this column
[xx]: Duplicate percentage due to coelutions, not taken into account in the consolidated 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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