Date : January 26, 2022

CERTIFICATE OF ANALYSIS – GC PROFILING

SAMPLE IDENTIFICATION

Internal code : 22A24-PTH02
Customer identification : Tea Tree ORGANIC - Australia - T30116209R
Type : Essential oil
Source : *Melaleuca alternifolia* ct. Terpinen-4-ol (Tea Tree)
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 2014-005
Analysis date : January 24, 2022

Checked and approved by :

Alexis St-Gelais, Ph. D., Chimiste 2013-174

Notes: This report may not be published, including online, without the written consent from Laboratoire PhytoChemia. This report is digitally signed, it is only considered valid if the digital signature is intact. The results only describe the samples that were submitted to the assays.

MÉTHODE CERTIFIÉE
✳ISO 17025:2017
CERTIFIED METHOD

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Essential oil, *Melaleuca alternifolia* ct. Terpinen-4-ol (Tea Tree)
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PHYSICOCHEMICAL DATA

Physical aspect: Clear liquid
Refractive index: 1.4788 ± 0.0003 (20 °C; method PC-MAT-016)

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
Ethanol	0.04	Aliphatic alcohol
Isobutyral	0.01	Aliphatic aldehyde
Isobutanol	tr	Aliphatic alcohol
Isovaleral	tr	Aliphatic aldehyde
2-Methylbutyral	0.01	Aliphatic aldehyde
Isoamyl alcohol	tr	Aliphatic alcohol
2-Methylbutanol	tr	Aliphatic alcohol
(3*Z*)-Hexenol	0.01	Aliphatic alcohol
α-Thujene	0.90	Monoterpene
α-Pinene	2.71	Monoterpene
α-Fenchene	0.01	Monoterpene
Camphene	0.02	Monoterpene
Sabinene	0.06	Monoterpene
β-Pinene	0.73	Monoterpene
3-Methyl-3-cyclohexenone	0.01	Aliphatic ketone
Myrcene	0.80	Monoterpene
Pseudolimonene	0.01	Monoterpene
α-Phellandrene	0.36	Monoterpene
α-Terpinene	7.75	Monoterpene
Carvomenthene	0.01	Aliphatic alcohol
meta-Cymene	tr	Monoterpene
para-Cymene	3.96	Monoterpene
Limonene	1.06	Monoterpene
1,8-Cineole	3.88	Monoterpenic ether
(*Z*)-β-Ocimene	0.01	Monoterpene
(*E*)-β-Ocimene	0.02	Monoterpene
γ-Terpinene	20.36	Monoterpene
cis-Sabinene hydrate	0.01	Monoterpenic alcohol
Terpinolene	2.96	Monoterpene
para-Cymenene	0.10	Monoterpene
trans-Sabinene hydrate	0.01	Monoterpenic alcohol
Linalool	0.08	Monoterpenic alcohol
Unknown	0.01	Monoterpenic alcohol
para-Mentha-1,3,8-triene	0.01	Monoterpene
endo-Fenchol	0.01	Monoterpenic alcohol
cis-para-Menth-2-en-1-ol	0.17	Monoterpenic alcohol
Cosmene isomer I	0.03	Monoterpene
trans-Pinocarveol	0.03	Monoterpenic alcohol
Camphor	0.01	Monoterpenic ketone
trans-para-Menth-2-en-1-ol	0.04	Monoterpenic alcohol
Unknown	0.09	Unknown
Camphene hydrate	0.01	Monoterpenic alcohol
δ-Terpineol	0.01	Monoterpenic alcohol
Terpinen-4-ol	38.27	Monoterpenic alcohol
Dill ether	0.02	Monoterpenic ether

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para-Cymen-8-ol	0.07	Monoterpenic alcohol
α-Terpineol	2.91	Monoterpenic alcohol
cis-Piperitol	0.04	Monoterpenic alcohol
Unknown	0.04	Oxygenated monoterpene
trans-Piperitol	0.08	Monoterpenic alcohol
exo-2-Hydroxycineole	0.02	Monoterpenic alcohol
cis-para-Mentha-1(7),8-dien-2-ol	0.01	Monoterpenic alcohol
Nerol	0.03	Monoterpenic alcohol
Unknown	0.01	Oxygenated monoterpene
Piperitone	0.02	Monoterpenic ketone
Unknown	0.01	Unknown
cis-Carvenone oxide?	0.02	Monoterpenic ketone
trans-Ascaridole glycol	0.04	Monoterpenic alcohol
Thymol	0.02	Monoterpenic alcohol
Carvacrol	0.02	Monoterpenic alcohol
Unknown	0.03	Monoterpenic alcohol
Bicycloelemene	0.01	Sesquiterpene
α-Cubebene	0.05	Sesquiterpene
Isoledene	0.08	Sesquiterpene
α-Copaene	0.13	Sesquiterpene
7-Cubebene	0.08	Sesquiterpene
7-Cubebene epimer?	0.03	Aliphatic alcohol
β-Elemene	0.02	Sesquiterpene
Unknown	0.04	Sesquiterpene
α-Gurjunene	0.46	Sesquiterpene
Methyleugenol	0.03	Phenylpropanoid
β-Maaliene	0.02	Sesquiterpene
β-Caryophyllene	0.44	Sesquiterpene
β-Ylangene	0.01	Sesquiterpene
γ-Maaliene	0.10	Sesquiterpene
β-Gurjunene	0.03	Sesquiterpene
α-Maaliene	0.10	Sesquiterpene
Aromadendrene	1.74	Sesquiterpene
Selina-5,11-diene	0.21	Sesquiterpene
trans-Muurola-3,5-diene	0.09	Sesquiterpene
α-Humulene	0.11	Sesquiterpene
allo-Aromadendrene	0.70	Sesquiterpene
Valerena-4,7(11)-diene	0.05	Sesquiterpene
γ-Gurjunene	0.08	Sesquiterpene
trans-Cadina-1(6),4-diene	0.30	Sesquiterpene
Selina-4,11-diene	0.03	Sesquiterpene
γ-Muurolene	0.01	Sesquiterpene
Germacrene D	0.01	Sesquiterpene
β-Selinene	0.16	Sesquiterpene
allo-Aromadendr-9-ene	0.14	Sesquiterpene
trans-Muurola-4(15),5-diene	0.05	Sesquiterpene
δ-Selinene	0.15	Sesquiterpene
α-Selinene	0.15	Sesquiterpene
Bicyclogermacrene	0.33	Sesquiterpene
Viridiflorene	1.12	Sesquiterpene
α-Muurolene	0.19	Sesquiterpene
γ-Cadinene	0.04	Sesquiterpene

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Essential oil, *Melaleuca alternifolia* ct. Terpinen-4-ol (Tea Tree)
Internal code: 22A24-PTH02

Tea Tree ORGANIC - Australia - T30116209R

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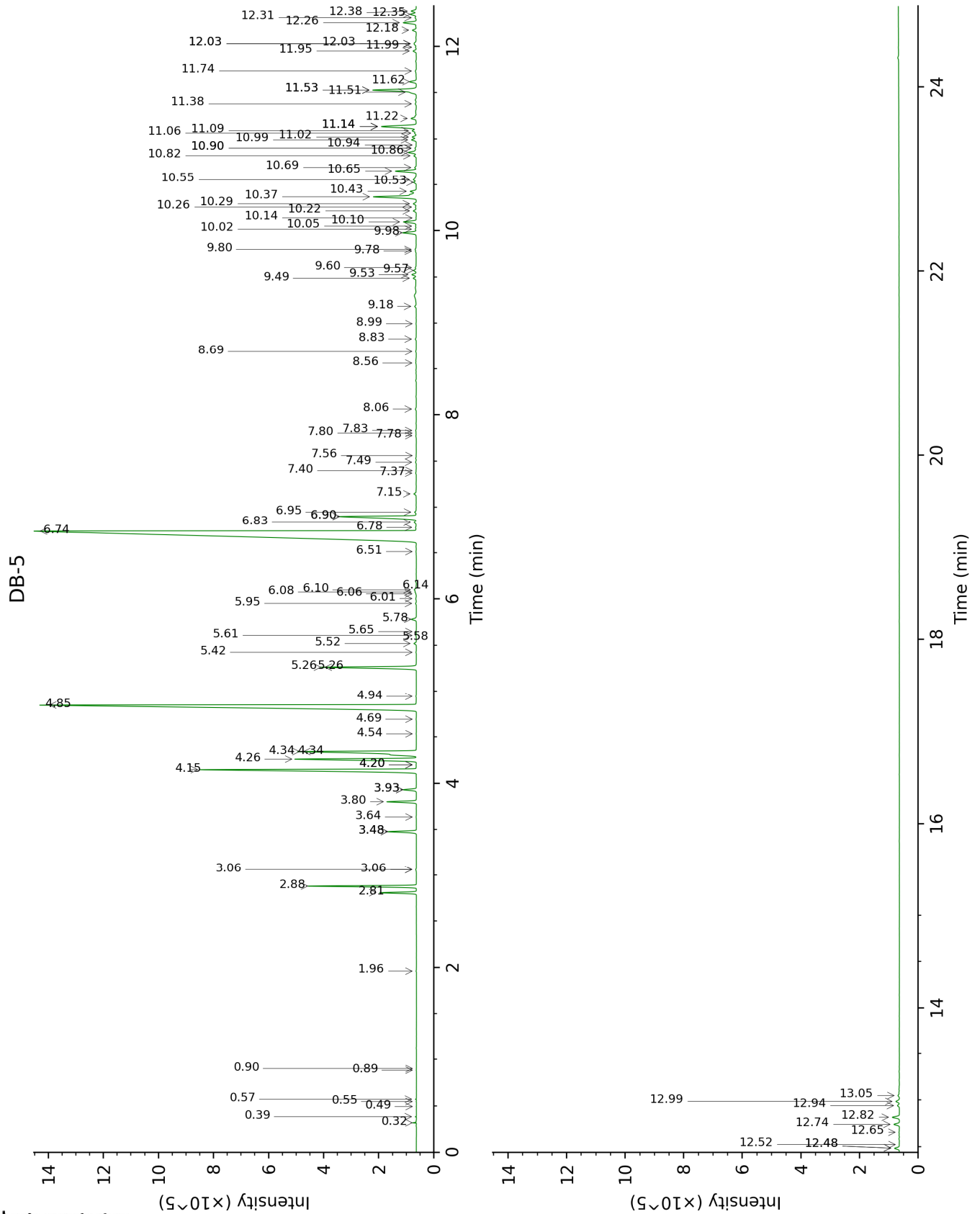|		
trans-Calamenene	0.20	Sesquiterpene
Zonarene	0.25	Sesquiterpene
δ-Cadinene	1.29	Sesquiterpene
trans-Cadina-1,4-diene	0.22	Sesquiterpene
α-Calacorene	0.04	Sesquiterpene
Epiglobulol	0.11	Sesquiterpenic alcohol
Eudesma-5,7(11)-diene	0.03	Sesquiterpene
Maaliol	0.06	Sesquiterpenic alcohol
Unknown	0.01	Oxygenated sesquiterpene
Palustrol	0.06	Sesquiterpenic alcohol
Spathulenol	0.14	Sesquiterpenic alcohol
Globulol	0.47	Sesquiterpenic alcohol
Gleenol	0.04	Sesquiterpenic alcohol
Viridiflorol	0.21	Sesquiterpenic alcohol
Cubeban-11-ol	0.18	Sesquiterpenic alcohol
Ledol	0.03	Sesquiterpenic alcohol
Eudesm-5-en-11-ol analog	0.13	Sesquiterpenic alcohol
Eudesm-5-en-11-ol	0.01	Sesquiterpenic alcohol
10-epi-Cubenol	0.02	Sesquiterpenic alcohol
Rosifoliol	0.18	Sesquiterpenic alcohol
1-epi-Cubenol	0.24	Sesquiterpenic alcohol
Isospathulenol	0.07	Sesquiterpenic alcohol
Cubenol	0.13	Sesquiterpenic alcohol
α-Muurolol	0.05	Sesquiterpenic alcohol
Consolidated total	**99.42%**	

tr: The compound has been detected below 0.005% of total signal.
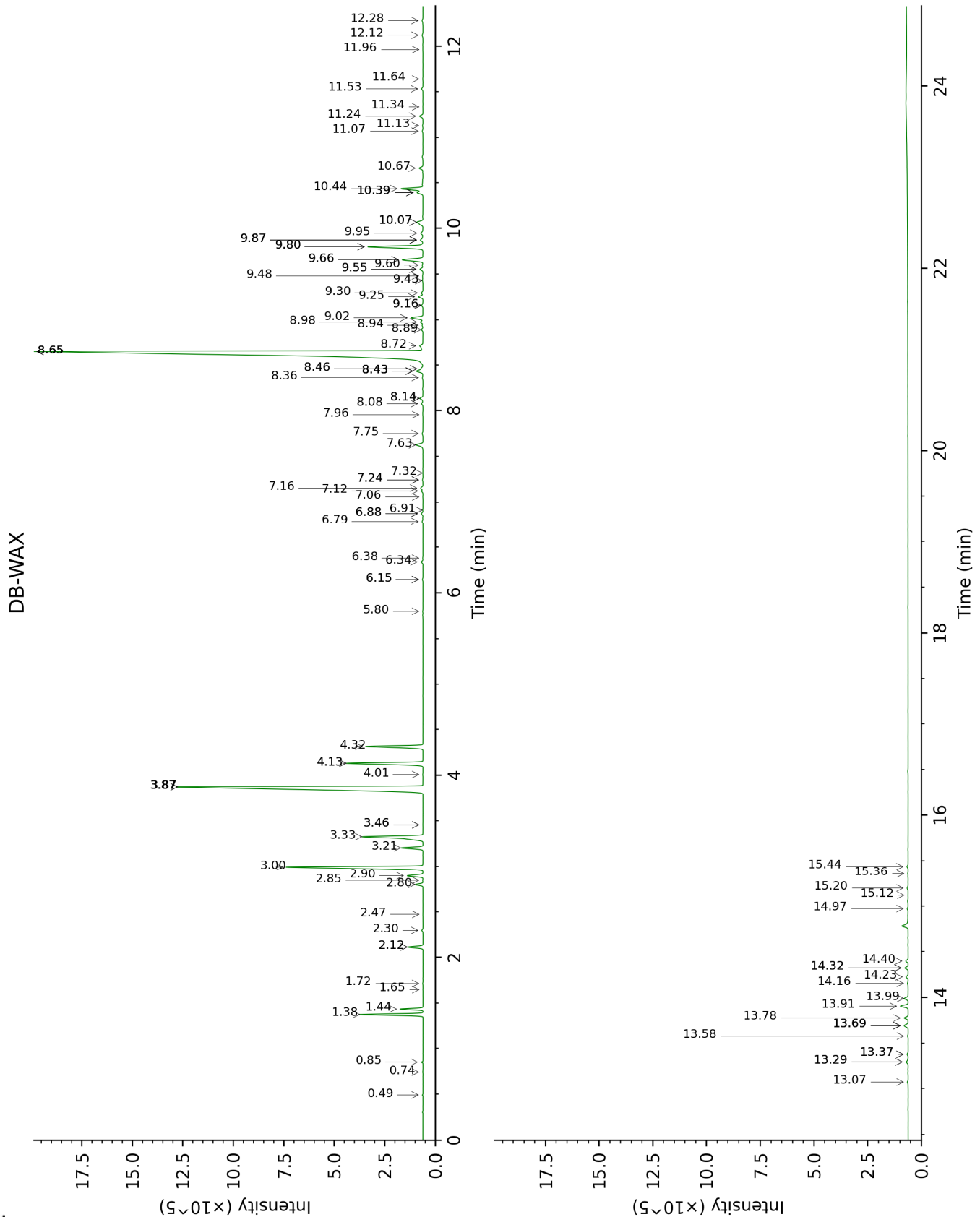
Note: no correction factor was applied

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.

Essential oil, *Melaleuca alternifolia* ct. Terpinen-4-ol (Tea Tree)

Internal code: 22A24-PTH02

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Essential oil, *Melaleuca alternifolia* ct. Terpinen-4-ol (Tea Tree)
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DB-5

Time (min)

Intensity (×10^5)

Time (min)

Intensity (×10^5)

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DB-WAX

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FULL ANALYSIS DATA

Identification	Column DB-5			Column DB-WAX		
	R.T	R.I	%	R.T	R.I	%
Ethanol	0.32	499	0.04	0.85	906	0.04
Isobutyral	0.38	536	0.01	0.49	781	0.01
Isobutanol	0.49	619	tr	2.12*	1066	0.74
Isovaleral	0.55	640	tr			
2-Methylbutyral	0.57	651	0.01	0.74	880	0.01
Isoamyl alcohol	0.88	732	tr	3.46*	1178	0.01
2-Methylbutanol	0.90	734	tr	3.46*	1178	[0.01]
(3*Z*)-Hexenol	1.96	858	0.01	5.80	1347	0.02
α-Thujene	2.81	926	0.90	1.44	999	0.89
α-Pinene	2.88	930	2.71	1.38	991	2.68
α-Fenchene	3.06*	943	0.02	1.65	1020	0.01
Camphene	3.06*	943	[0.02]	1.72	1026	0.02
Sabinene	3.48*	971	0.79	2.30	1084	0.06
β-Pinene	3.48*	971	[0.79]	2.12*	1066	[0.74]
3-Methyl-3-cyclohexenone	3.64	982	0.01	6.15*	1372	0.03
Myrcene	3.80	993	0.80	2.90	1134	0.80
Pseudolimonene	3.93*	1002	0.38	2.84	1130	0.01
α-Phellandrene	3.93*	1002	[0.38]	2.80	1126	0.36
α-Terpinene	4.15	1016	7.75	3.00	1141	7.72
Carvomenthene	4.20*	1019	0.01	2.47	1100	0.01
meta-Cymene	4.20*	1019	[0.01]	4.13*	1229	3.96
para-Cymene	4.26	1023	3.96	4.13*	1229	[3.96]
Limonene	4.34*	1028	4.97	3.21	1158	1.06
1,8-Cineole	4.34*	1028	[4.97]	3.33	1168	3.88
(*Z*)-β-Ocimene	4.54	1040	0.01	3.87*	1210	20.29
(*E*)-β-Ocimene	4.69	1050	0.02	4.01	1220	0.02
γ-Terpinene	4.85	1060	20.36	3.87*	1210	[20.29]
cis-Sabinene hydrate	4.94	1066	0.01	6.91	1428	0.01
Terpinolene	5.26*	1086	3.06	4.32	1243	2.96
para-Cymenene	5.26*	1086	[3.06]	6.34	1386	0.10
trans-Sabinene hydrate	5.42	1097	0.01	7.96	1506	0.01
Linalool	5.52	1103	0.08	8.08	1516	0.08
Unknown [m/z 119, 109 (94), 43 (61), 95 (56), 91 (48), 77 (32), 152 (32), 137 (31), 134 (24)]	5.58	1107	0.01	8.46*	1545	0.08
para-Mentha-1,3,8-triene	5.61	1108	0.01	6.15*	1372	[0.03]
endo-Fenchol	5.65	1111	0.01	8.43*	1543	0.46
cis-para-Menth-2-en-1-ol	5.78	1120	0.17	8.14*	1520	0.19
Cosmene isomer I	5.95	1131	0.03	6.38	1389	0.02
trans-Pinocarveol	6.01	1134	0.03	9.16*	1600	0.08

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Camphor	6.06	1137	0.01	7.24*	1453	0.03
trans-para-Menth-2-en-1-ol	6.08	1138	0.04	8.98	1586	0.14
Unknown [m/z 109, 124 (45), 119 (41), 43 (35), 91 (28), 95 (25)...]	6.10	1140	0.09	6.88*	1425	0.10
Camphene hydrate	6.14	1142	0.01	8.46*	1545	[0.08]
δ-Terpineol	6.52	1167	0.01	9.48	1626	0.03
Terpinen-4-ol	6.74	1181	38.27	8.65*	1560	40.01
Dill ether	6.78	1184	0.02	7.32	1458	0.01
para-Cymen-8-ol	6.83	1187	0.07	11.53	1797	0.08
α-Terpineol	6.90*	1191	2.96	9.80*	1652	3.08
cis-Piperitol	6.90*	1191	[2.96]	9.60	1635	0.04
Unknown [m/z 121, 43 (99), 91 (85), 77 (73), 93 (41), 136 (33)... 166 (3)]	6.95	1194	0.04			
trans-Piperitol	7.15	1207	0.08	10.39*	1700	0.37
exo-2-Hydroxycineole	7.37	1222	0.02	11.64	1806	0.02
cis-para-Mentha-1(7),8-dien-2-ol	7.40	1224	0.01	11.96	1835	0.01
Nerol	7.49	1230	0.03	11.07	1758	0.04
Unknown [m/z 137, 152 (28), 43 (25), 91 (24), 109 (23), 119 (19)]	7.56	1235	0.01	11.34	1780	0.01
Piperitone	7.78	1250	0.02	9.87*	1658	0.18
Unknown [m/z 43, 82 (79), 109 (69), 110 (65), 95 (38), 41 (36)...]	7.80	1251	0.01			
cis-Carvenone oxide?	7.83	1253	0.02			
trans-Ascaridole glycol	8.06	1269	0.04	14.16	2037	0.05
Thymol	8.56	1302	0.02	15.12	2131	0.01
Carvacrol	8.69	1311	0.02	15.36	2154	0.02
Unknown [m/z 97, 112 (92), 83 (62), 43 (44), 41 (25)... 170? (4)]	8.83	1321	0.03	14.97	2116	0.04
Bicycloelemene	9.00	1333	0.01	7.06	1439	0.01
α-Cubebene	9.18	1346	0.05	6.79	1419	0.05
Isoledene	9.49	1368	0.08	6.88*	1425	[0.10]
α-Copaene	9.53	1371	0.13	7.16	1446	0.14
7-Cubebene	9.57	1374	0.08	7.12	1444	0.07
7-Cubebene epimer?	9.60	1376	0.03	7.24*	1453	[0.03]

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β-Elemene	9.78	1388	0.02	8.43*	1543	[0.46]
Unknown [m/z 93, 122 (98), 161 (98), 107 (86), 95 (46), 105 (72)... 204 (34)]	9.80	1390	0.04			
α-Gurjunene	9.98	1403	0.46	7.63	1481	0.45
Methyleugenol	10.02	1405	0.03	13.37*	1962	0.06
β-Maaliene	10.05	1408	0.02	7.75	1490	0.05
β-Caryophyllene	10.10	1411	0.44	8.43*	1543	[0.46]
β-Ylangene	10.14	1414	0.01	8.14*	1520	[0.19]
γ-Maaliene	10.22	1420	0.10	8.43*	1543	[0.46]
β-Gurjunene	10.26	1423	0.03	8.36	1538	0.05
α-Maaliene	10.29	1426	0.10	8.65*	1560	[40.01]
Aromadendrene	10.37	1432	1.74	8.65*	1560	[40.01]
Selina-5,11-diene	10.43	1436	0.21	8.72	1565	0.30
trans-Muurola-3,5-diene	10.53	1443	0.09	8.89	1579	0.09
α-Humulene	10.56	1446	0.11	9.30	1611	0.09
allo-Aromadendrene	10.65	1453	0.70	9.02	1589	0.69
Valerena-4,7(11)-diene	10.69	1456	0.05	8.94	1583	0.05
γ-Gurjunene	10.82	1465	0.08	9.16*	1600	[0.08]
trans-Cadina-1(6),4-diene	10.86	1468	0.30	9.25	1607	0.26
Selina-4,11-diene	10.90*	1471	0.05	9.43	1622	0.03
γ-Muurolene	10.90*	1471	[0.05]	9.56*	1632	0.18
Germacrene D	10.94	1474	0.01	9.80*	1652	[3.08]
β-Selinene	10.99	1478	0.16	9.87*	1658	[0.18]
allo-Aromadendr-9-ene	11.02	1480	0.14	9.56*	1632	[0.18]
trans-Muurola-4(15),5-diene	11.06	1484	0.05	9.87*	1658	[0.18]
δ-Selinene	11.09	1486	0.15	9.66*	1640	1.27
α-Selinene	11.14*	1489	1.48	9.95	1664	0.15
Bicyclogermacrene	11.14*	1489	[1.48]	10.07*	1674	0.52
Viridiflorene	11.14*	1489	[1.48]	9.66*	1640	[1.27]
α-Muurolene	11.22	1496	0.19	10.07*	1674	[0.52]
γ-Cadinene	11.38	1508	0.04	10.39*	1700	[0.37]
trans-Calamenene	11.51†	1517	1.75	11.24	1771	0.20
Zonarene	11.53*†	1519	[1.75]	10.39*	1700	[0.37]
δ-Cadinene	11.53*†	1519	[1.75]	10.44	1704	1.29
trans-Cadina-1,4-diene	11.62	1526	0.22	10.67	1723	0.22
α-Calacorene	11.74	1535	0.04	12.12	1849	0.06
Epiglobulol	11.95	1552	0.11	13.29*	1955	0.12
Eudesma-5,7(11)-diene	11.99	1556	0.03	11.13	1763	0.03
Maaliol	12.03*	1559	0.13	13.07	1935	0.06
Unknown [m/z 161, 109 (98), 82 (93), 43 (72), 105	12.03*	1559	[0.13]	13.29*	1955	[0.12]

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(68), 93 (59), 69 (56), 119 (55)... 222 (7)]						
Palustrol	12.03*	1559	[0.13]	12.28	1863	0.06
Spathulenol	12.18	1570	0.14	14.40	2060	0.14
Globulol	12.26	1576	0.47	13.91	2012	0.45
Gleenol	12.31	1581	0.04	13.58	1982	0.04
Viridiflorol	12.35	1584	0.21	13.99	2021	0.23
Cubeban-11-ol	12.38	1586	0.18	13.69*	1992	0.28
Ledol	12.48*	1594	0.17	13.37*	1962	[0.06]
Eudesm-5-en-11-ol analog	12.48*	1594	[0.17]	14.23	2043	0.13
Eudesm-5-en-11-ol	12.52	1597	0.01	14.32*	2053	0.18
10-epi-Cubenol	12.66	1608	0.02	13.69*	1992	[0.28]
Rosifoliol	12.74	1615	0.18	14.32*	2053	[0.18]
1-epi-Cubenol	12.82	1621	0.24	13.78	2000	0.23
Isospathulenol	12.94	1632	0.07	15.44	2162	0.06
Cubenol	12.99	1635	0.13	13.69*	1992	[0.28]
α-Muurolol	13.05	1640	0.05	15.20	2139	0.06
Total identified	**99.11%**			**99.19%**		
Total reported	**99.35%**			**99.25%**		

*: 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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