



GC/MS BATCH NUMBER: DC0101

ESSENTIAL OIL: DOUGLAS FIR

BOTANICAL NAME: PSEUDOTSUGA MENZIESII

ORIGIN: CANADA

KEY CONSTITUENTS PRESENT IN THIS BATCH OF DOUGLAS FIR OIL	%
β-PINENE	23.8
TERPINOLENE	15.5
SABINENE	14.4
Δ3-CARENE	9.1
α-PINENE	8.8
TERPINEN-4-ol	4.5
CITRONELLYL ACETATE	2.9
LIMONENE	2.6
γ-TERPINENE	2.4
MYRCENE	1.9
GERANYL ACETATE	1.8
CITRONELLOL	1.7
α-TERPINENE	1.3
β-PHELLANDRENE + 1,8-CINEOLE	1.1

Date : September 12, 2018

CERTIFICATE OF ANALYSIS – GC PROFILING

SAMPLE IDENTIFICATION

Internal code : 18I05-PTH4-1-CC

Customer identification : Douglas Fir - Canada - DC010175R

Type : Essential oil

Source : *Pseudotsuga menziesii*

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 : Benoit Roger, Ph. D.

Analysis date : September 07, 2018

Checked and approved by :

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

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PHYSICOCHEMICAL DATA

Physical aspect: Clear liquid

Refractive index: 1.4735 ± 0.0003 (20 °C)

CONCLUSION

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

ANALYSIS SUMMARY

Identification	DB-5 (%)	DB-WAX (%)	Classe
3-Methylcyclopentene	0.01	0.01	Alkene
Methyl isobutyrate	tr	tr	Aliphatic ester
3-Pentanone	0.01	0.01	Aliphatic ketone
Toluene	0.01	0.38*	Simple phenolic
(2E)-Hexenal	0.05*	0.01	Aliphatic aldehyde
Ethyl 2-methylbutyrate	[0.05]*	0.06*	Aliphatic ester
(3Z)-Hexenol	0.19*	0.24*	Aliphatic alcohol
Unknown	[0.19]*	0.01	Unknown
Hexanol	0.03	0.04*	Aliphatic alcohol
Hashishene	tr	8.91*	Monoterpene
Tricyclene	0.02	0.02	Monoterpene
α -Thujene	0.35	[0.38]*	Monoterpene
α -Pinene	8.82	[8.91]*	Monoterpene
Camphene	0.28*	0.26	Monoterpene
α -Fenchene	[0.28]*	[0.06]*	Monoterpene
β -Pinene	38.09*	23.82	Monoterpene
Sabinene	[38.09]*	14.40	Monoterpene
3-Methyl-3-cyclohexenone	[38.09]*	0.04*	Aliphatic ketone
Myrcene	1.85	1.81	Monoterpene
Pseudolimonene	0.20*	0.01	Monoterpene
Ethyl hexanoate	[0.20]*	0.06	Aliphatic ester
α -Phellandrene	[0.20]*	0.11	Monoterpene
Δ^3 -Carene	8.98*	9.14	Monoterpene
(3Z)-Hexenyl acetate	[8.98]*	0.03	Aliphatic ester
α -Terpinene	1.27	1.13	Monoterpene
para-Cymene	0.56	0.57	Monoterpene
Limonene	3.73*	2.64	Monoterpene
β -Phellandrene	[3.73]*	1.08*	Monoterpene
1,8-Cineole	[3.73]*	[1.08]*	Monoterpenic ether
(Z)- β -Ocimene	0.29	0.31	Monoterpene
(E)- β -Ocimene	0.51	0.57	Monoterpene
Unknown	0.12	0.06	Unknown
γ -Terpinene	2.43	2.47	Monoterpene
cis-Sabinene hydrate	0.12*	0.07	Monoterpenic alcohol
Unknown	[0.12]*		Unknown
Unknown	0.01	0.01	Unknown
Terpinolene isomer	0.13	[15.49]	Monoterpene
Terpinolene	15.55*	15.49	Monoterpene
para-Cymenene	[15.55]*	0.21	Monoterpene
trans-Sabinene hydrate	[15.55]*	0.09	Monoterpenic alcohol
α -Pinene oxide	0.03	[0.04]*	Monoterpenic ether
Unknown	0.21*	[0.24]*	Oxygenated monoterpene
Linalool	[0.21]*	0.29*	Monoterpenic alcohol
Unknown	0.01	0.20*	Monoterpenic alcohol
para-Mentha-1,3,8-triene	0.03	[0.04]*	Monoterpene
endo-Fenchol	0.03*	0.03	Monoterpenic alcohol
cis-Rose oxide	[0.03]*	0.01	Monoterpenic ether
(E)-4,8-Dimethylnona-1,3,7-triene	0.01	tr	Terpene derivative

<i>cis</i> -para-Menth-2-en-1-ol	0.13	0.13	Monoterpenic alcohol
Methyl octanoate	0.01	tr	Aliphatic ester
Cosmene?	0.05		Monoterpene
<i>trans</i> -Pinocarveol	0.07*	0.04	Monoterpenic alcohol
1-Terpineol	[0.07]*	0.03	Monoterpenic alcohol
<i>trans</i> -para-Menth-2-en-1-ol	0.09	0.10	Monoterpenic alcohol
Camphene hydrate	0.17*	[0.20]*	Monoterpenic alcohol
Epoxyterpinolene	[0.17]*	0.12*	Monoterpenic ether
Citronellal	0.15*	0.16*	Monoterpenic aldehyde
Pinocamphone	[0.15]*	0.01	Monoterpenic ketone
Pinocarvone	0.01	0.01	Monoterpenic ketone
Borneol	0.03	0.41*	Monoterpenic alcohol
Terpinen-4-ol	4.54*	4.54	Monoterpenic alcohol
Unknown	[4.54]*	0.04	Oxygenated monoterpene
Unknown	0.02		Oxygenated monoterpene
para-Cymen-8-ol	0.19	0.17	Monoterpenic alcohol
α -Terpineol	0.41	[0.41]*	Monoterpenic alcohol
Methyl salicylate	0.08*	0.05*	Phenolic ester
Myrtenol	[0.08]*	0.03	Monoterpenic alcohol
γ -Terpineol	[0.08]*	0.02	Monoterpenic alcohol
Unknown	0.05*		Oxygenated monoterpene
Ethyl octanoate	[0.05]*	0.06	Aliphatic ester
<i>trans</i> -Piperitol	0.04	0.10*	Monoterpenic alcohol
Unknown	0.01	0.01	Oxygenated monoterpene
Nerol	tr	0.02	Monoterpenic alcohol
Citronellol	1.75*	1.72	Monoterpenic alcohol
Thymol methyl ether	[1.75]*	[0.20]*	Monoterpenic ether
Unknown	0.13	0.13	Oxygenated monoterpene
Neral	0.38	2.95*	Monoterpenic aldehyde
Piperitone	0.03	0.07	Monoterpenic ketone
Geraniol	0.16	0.14	Monoterpenic alcohol
Unknown	0.04		Unknown
Unknown	0.05	0.01	Oxygenated monoterpene
Bornyl acetate	0.14	0.13	Monoterpenic ester
<i>trans</i> -Pinocarvyl acetate	tr	0.01	Monoterpenic ester
Unknown	0.01		Unknown
Citronellic acid	0.09		Monoterpenic acid
δ -Elemene	0.07	[0.16]*	Sesquiterpene
Unknown	0.01	0.01	Unknown
α -Longipinene	0.06	[0.12]*	Sesquiterpene
Citronellyl acetate	2.90	[2.95]*	Monoterpenic ester
Unknown	0.03*		Unknown
Unknown	[0.03]*		Unknown
Ethyl (4 <i>E</i>)-decenoate	0.02	[2.95]*	Aliphatic ester
Geranyl acetate	1.82	1.83*	Monoterpenic ester
β -Elemene	0.05	[0.20]*	Sesquiterpene
Longifolene	0.13	[0.29]*	Sesquiterpene
Ethyl decanoate	0.11	0.12*	Aliphatic ester
β -Caryophyllene	0.06	[0.20]*	Sesquiterpene
<i>trans</i> - α -Bergamotene	0.08*	[0.20]*	Sesquiterpene
Unknown	[0.08]*		Oxygenated monoterpene
α -Guaiene	[0.08]*	[0.20]*	Sesquiterpene

6,9-Guaiadiene	0.03	0.02	Sesquiterpene
Unknown	0.03	0.01	Sesquiterpene
α -Humulene	0.12	[0.12]*	Sesquiterpene
(E)- β -Farnesene	0.02	0.03	Sesquiterpene
γ -Murolene	0.01	0.02	Sesquiterpene
Germacrene D	0.35	0.33	Sesquiterpene
Unknown	0.06*	0.07	Sesquiterpene
δ -Selinene	[0.06]*	0.01	Sesquiterpene
α -Murolene	0.01	0.04	Sesquiterpene
(Z)- α -Bisabolene	0.08*	[0.10]*	Sesquiterpene
Methyl (E)-isoeugenol	[0.08]*	0.01	Phenylpropanoid
γ -Cadinene	0.04*	[0.10]*	Sesquiterpene
(3E,6E)- α -Farnesene	[0.04]*	[1.83]*	Sesquiterpene
δ -Cadinene	0.06	[0.05]*	Sesquiterpene
(E)- α -Bisabolene	0.06	0.10	Sesquiterpene
Ethyl dodecanoate	0.02	0.02	Aliphatic ester
Selin-6-en-4 α -ol?	0.03	0.03	Sesquiterpenic alcohol
Cubenol	0.01	0.01	Sesquiterpenic alcohol
(2E,6E)-Farnesol	0.02	0.03	Sesquiterpenic alcohol
(2E,6E)-Farnesyl acetate	0.01	0.01	Sesquiterpenic ester
(Z)-Abienol	0.06	0.05	Diterpenic alcohol
Total identified	98.68%	98.17%	

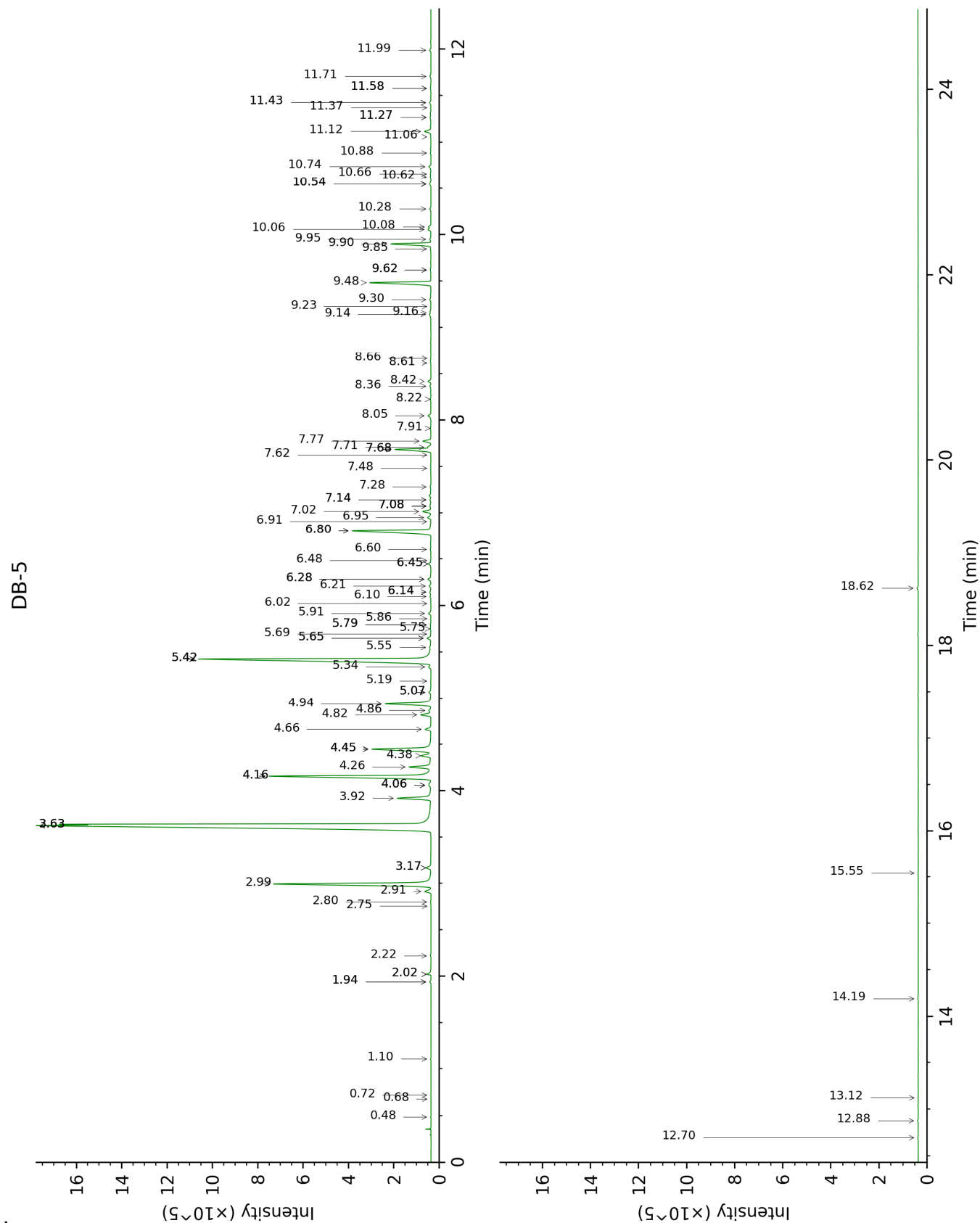
*: Two or more compounds are coeluting on this column

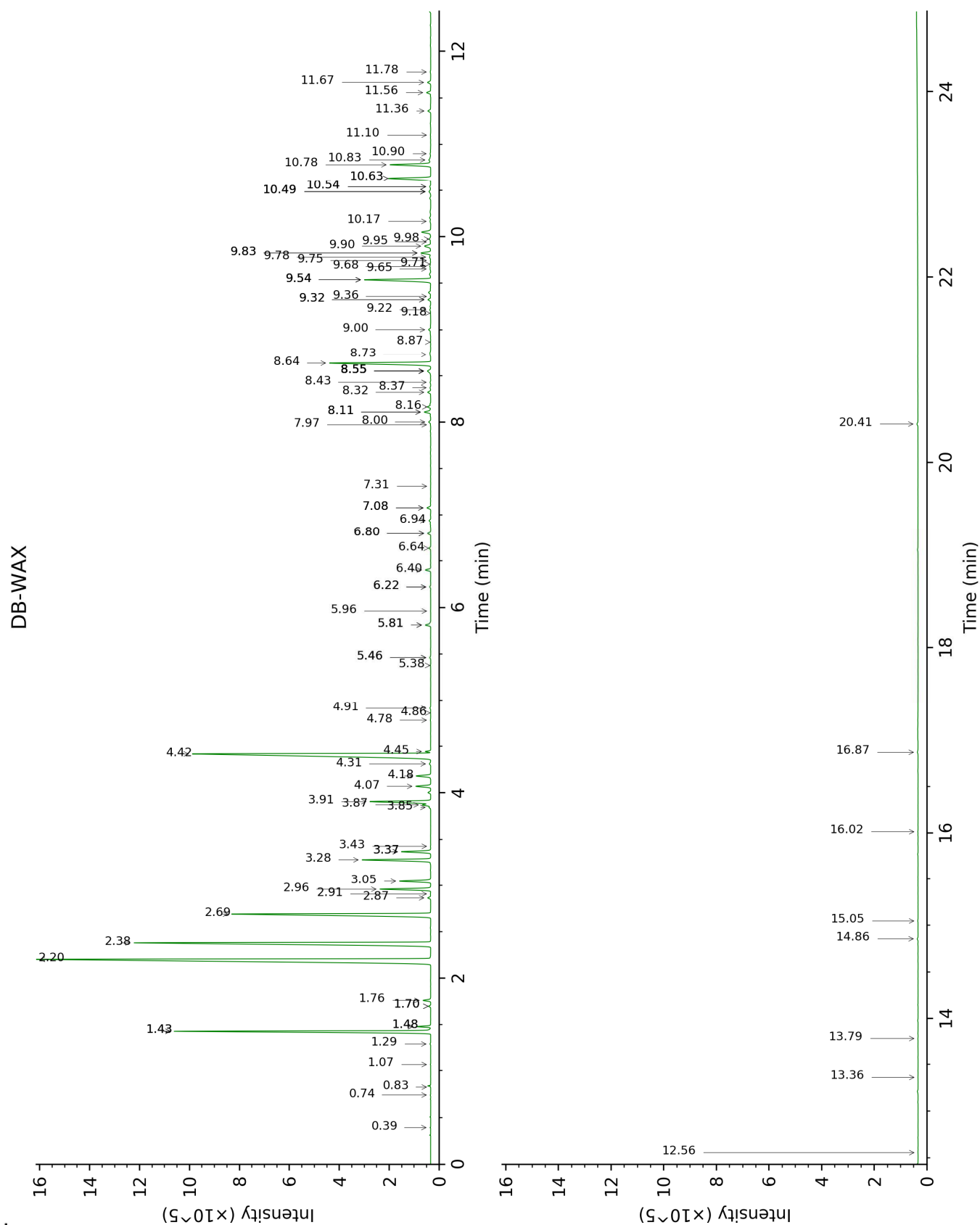
[xx]: Duplicate percentage due to coelutions, not taken account in the identified total

tr: The compound has been detected below 0.005% of total signal.

Note: no correction factor was applied

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FULL ANALYSIS DATA

Identification	Column DB-5			Column DB-WAX		
	R.T	R.I	%	R.T	R.I	%
3-Methylcyclopentene	0.48	604	0.01	0.39	675	0.01
Methyl isobutyrate	0.68	675	tr	0.83	900	tr
3-Pentanone	0.72	690	0.01	1.07	939	0.01
Toluene	1.10	755	0.01	1.48*	1003	0.38
(2E)-Hexenal	1.94*	846	0.05	3.43	1175	0.01
Ethyl 2-methylbutyrate	1.94*	846	[0.05]	1.70*	1024	0.06
(3Z)-Hexenol	2.02*	853	0.19	5.81*	1347	0.24
Unknown [m/z 55, 83 (89), 82 (70), 67 (66), 41 (55), 69 (46), 111 (37)... 126 (2)]	2.02*	853	[0.19]	0.74	874	0.01
Hexanol	2.22	870	0.03	5.46*	1322	0.04
Hashishene	2.75	913	tr	1.43*	998	8.91
Tricyclene	2.80	916	0.02	1.29	976	0.02
α -Thujene	2.91	923	0.35	1.48*	1003	[0.38]
α -Pinene	2.99	929	8.82	1.43*	998	[8.91]
Camphene	3.17*	941	0.28	1.76	1030	0.26
α -Fenchene	3.17*	941	[0.28]	1.70*	1024	[0.06]
β -Pinene	3.63*	971	38.09	2.20	1074	23.82
Sabinene	3.63*	971	[38.09]	2.38	1092	14.40
3-Methyl-3-cyclohexenone	3.63*	971	[38.09]	6.22*	1376	0.04
Myrcene	3.92	991	1.85	2.96	1139	1.81
Pseudolimonene	4.06*	1000	0.20	2.91	1135	0.01
Ethyl hexanoate	4.06*	1000	[0.20]	3.84	1206	0.06
α -Phellandrene	4.06*	1000	[0.20]	2.86	1132	0.11
Δ^3 -Carene	4.16*	1007	8.98	2.69	1119	9.14
(3Z)-Hexenyl acetate	4.16*	1007	[8.98]	4.91	1282	0.03
α -Terpinene	4.26	1013	1.27	3.05	1146	1.13
para-Cymene	4.38	1020	0.56	4.18	1230	0.57
Limonene	4.45*	1025	3.73	3.28	1164	2.64
β -Phellandrene	4.45*	1025	[3.73]	3.37*	1170	1.08
1,8-Cineole	4.45*	1025	[3.73]	3.37*	1170	[1.08]
(Z)- β -Ocimene	4.66	1038	0.29	3.87	1208	0.31
(E)- β -Ocimene	4.82	1048	0.51	4.07	1223	0.57
Unknown [m/z 115, 97 (84), 155 (69), 55 (51), 69 (50), 43 (46)...]	4.86	1051	0.12	4.31	1240	0.06
γ -Terpinene	4.94	1056	2.43	3.91	1211	2.47
cis-Sabinene hydrate	5.06*	1064	0.12	6.94	1428	0.07
Unknown [m/z 115, 43 (92), 97 (92), 69 (70), 155 (70), 55 (70)]	5.06*	1064	[0.12]			

(69)...						
Unknown [m/z 101, 88 (98), 43 (54), 55 (44), 41 (40), 95 (40), 73 (36)...	5.19	1072	0.01	4.78	1273	0.01
Terpinolene isomer	5.34	1081	0.13	4.45†	1249	[15.49]
Terpinolene	5.42*	1087	15.55	4.42†	1247	15.49
para-Cymenene	5.42*	1087	[15.55]	6.40	1389	0.21
trans-Sabinene hydrate	5.42*	1087	[15.55]	8.00	1507	0.09
α-Pinene oxide	5.55	1094	0.03	5.46*	1322	[0.04]
Unknown [m/z 95, 150 (45), 110 (35), 107 (23), 109 (21)]	5.65*	1101	0.21	5.81*	1347	[0.24]
Linalool	5.65*	1101	[0.21]	8.11*	1515	0.29
Unknown [m/z 119, 109 (94), 43 (61), 95 (56), 91 (48), 77 (32), 152 (32), 137 (31), 134 (24)]	5.69	1104	0.01	8.55*	1549	0.20
para-Mentha-1,3,8-triene	5.75	1107	0.03	6.22*	1376	[0.04]
endo-Fenchol	5.79*	1110	0.03	8.43	1540	0.03
cis-Rose oxide	5.79*	1110	[0.03]	5.38	1316	0.01
(E)-4,8-Dimethylnona-1,3,7-triene	5.86	1114	0.01	4.86	1279	tr
cis-para-Menth-2-en-1-ol	5.91	1118	0.13	8.16	1519	0.13
Methyl octanoate	6.02	1125	0.01	5.96	1357	tr
Cosmene?	6.10	1129	0.05			
trans-Pinocarveol	6.14*	1132	0.07	9.22	1601	0.04
1-Terpineol	6.14*	1132	[0.07]	8.37	1535	0.03
trans-para-Menth-2-en-1-ol	6.21	1137	0.09	9.00	1584	0.10
Camphene hydrate	6.28*	1141	0.17	8.55*	1549	[0.20]
Epoxyterpinolene	6.28*	1141	[0.17]	6.80*	1418	0.12
Citronellal	6.45*	1152	0.15	7.08*	1438	0.16
Pinocamphone	6.45*	1152	[0.15]	7.31	1455	0.01
Pinocarvone	6.48	1154	0.01	7.97	1504	0.01
Borneol	6.60	1162	0.03	9.83*	1650	0.41
Terpinen-4-ol	6.80*	1175	4.54	8.64	1556	4.54
Unknown [m/z 69, 84 (62), 41 (30), 123 (26), 97 (24), 109 (23)...	6.80*	1175	[4.54]	9.68	1638	0.04
Unknown [m/z 96, 119 (99), 96 (86), 91 (81), 43 (65), 41 (49), 67 (45)...	6.91	1182	0.02			
para-Cymen-8-ol	6.95	1184	0.19	11.56	1795	0.17
α-Terpineol	7.02	1188	0.41	9.83*	1650	[0.41]

Methyl salicylate	7.08*	1192	0.08	10.54*	1708	0.05
Myrtenol	7.08*	1192	[0.08]	10.90	1739	0.03
γ-Terpineol	7.08*	1192	[0.08]	9.95	1660	0.02
Unknown [m/z 121, 43 (99), 91 (85), 77 (73), 93 (41), 136 (33)... 166 (3)]	7.14*	1196	0.05			
Ethyl octanoate	7.14*	1196	[0.05]	6.64	1406	0.06
trans-Piperitol	7.28	1206	0.04	10.49*	1704	0.10
Unknown [m/z 122, 91 (56), 79 (33), 95 (33), 107 (31), 43 (30), 77 (30), 135 (27)... 150 (9)]	7.48	1219	0.01	9.36	1612	0.01
Nerol	7.62	1229	tr	11.10	1756	0.02
Citronellol	7.68*	1233	1.75	10.78	1729	1.72
Thymol methyl ether	7.68*	1233	[1.75]	8.55*	1549	[0.20]
Unknown [m/z 137, 152 (28), 43 (25), 91 (24), 109 (23), 119 (19)]	7.71	1234	0.13	11.36	1778	0.13
Neral	7.77	1239	0.38	9.54*	1627	2.95
Piperitone	7.91	1248	0.03	9.98	1662	0.07
Geraniol	8.05	1257	0.16	11.67	1804	0.14
Unknown [m/z 88, 101 (61), 55 (39), 41 (34), 83 (30), 70 (24), 43 (24)...]	8.22	1269	0.04			
Unknown [m/z 95, 67 (45), 41 (42), 110 (42), 43 (41), 59 (36)]	8.36	1278	0.05	12.56	1883	0.01
Bornyl acetate	8.42	1282	0.14	8.32	1532	0.13
trans-Pinocarvyl acetate	8.61	1295	tr	9.18	1598	0.01
Unknown [m/z 112, 97 (93), 83 (60), 43 (46), 41 (20), 69 (19)...]	8.66	1298	0.01			
Citronellic acid	9.14	1332	0.09			
δ-Elemene	9.16	1333	0.07	7.08*	1438	[0.16]
Unknown [m/z 43, 135 (95), 41 (75), 107 (73), 95 (53), 55 (51)...]	9.23	1338	0.01	13.36	1957	0.01
α-Longipinene	9.30	1343	0.06	6.80*	1418	[0.12]
Citronellyl acetate	9.48	1356	2.90	9.54*	1627	[2.95]
Unknown [m/z 43, 95 (53), 121 (47), 107 (38), 93 (36), 41 (35), 67 (31)...]	9.62*	1366	0.03			
Unknown [m/z 69,	9.62*	1366	[0.03]			

43 (79), 93 (68), 41 (66), 111 (43), 55 (41), 68 (37)...						
Ethyl (4E)-decenoate	9.85	1382	0.02	9.54*	1627	[2.95]
Geranyl acetate	9.90	1385	1.82	10.63*	1716	1.83
β-Elementene	9.95	1389	0.05	8.55*	1549	[0.20]
Longifolene	10.06	1396	0.13	8.11*	1515	[0.29]
Ethyl decanoate	10.08	1398	0.11	9.32*	1610	0.12
β-Caryophyllene	10.28	1412	0.06	8.55*	1549	[0.20]
trans-α-Bergamotene	10.54*	1432	0.08	8.55*	1549	[0.20]
Unknown [m/z 135, 91 (47), 93 (41), 107 (36), 43 (31), 77 (26), 137 (25)... 168 (3)]	10.54*	1432	[0.08]			
α-Guaiene	10.54*	1432	[0.08]	8.55*	1549	[0.20]
6,9-Guaiadiene	10.62	1438	0.03	8.73	1563	0.02
Unknown [m/z 91, 161 (92), 105 (85), 119 (63), 133 (53), 79 (49), 204 (46)]	10.66	1441	0.03	8.87	1574	0.01
α-Humulene	10.74	1447	0.12	9.32*	1610	[0.12]
(E)-β-Farnesene	10.88	1458	0.02	9.66	1636	0.03
γ-Murolene	11.06	1471	0.01	9.71	1640	0.02
Germacrene D	11.12	1475	0.35	9.90	1656	0.33
Unknown [m/z 79, 107 (99), 91 (88), 93 (86), 81 (78), 105 (73), 41 (73)... 204? (12)]	11.27*	1486	0.06	9.78	1646	0.07
δ-Selinene	11.27*	1486	[0.06]	9.75	1644	0.01
α-Murolene	11.37	1494	0.01	10.17	1678	0.04
(Z)-α-Bisabolene	11.43*	1498	0.08	10.49*	1704	[0.10]
Methyl (E)-isoeugenol	11.43*	1498	[0.08]	15.05	2119	0.01
γ-Cadinene	11.58*	1510	0.04	10.49*	1704	[0.10]
(3E,6E)-α-Farnesene	11.58*	1510	[0.04]	10.63*	1716	[1.83]
δ-Cadinene	11.71	1520	0.06	10.54*	1708	[0.05]
(E)-α-Bisabolene	11.99	1542	0.06	10.83	1733	0.10
Ethyl dodecanoate	12.70	1598	0.02	11.78	1814	0.02
Selin-6-en-4α-ol?	12.88	1612	0.03	14.86	2099	0.03
Cubenol	13.12	1633	0.01	13.79	1996	0.01
(2E,6E)-Farnesol	14.19	1722	0.02	16.87	2306	0.03
(2E,6E)-Farnesyl acetate	15.55	1842	0.01	16.02	2216	0.01
(Z)-Abienol	18.62	2138	0.06	20.41	2711	0.05
Total identified	98.68%			98.17%		
Total reported	99.12%			98.53%		

*: 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