CERTIFICATE OF ANALYSIS – GC PROFILING

SAMPLE IDENTIFICATION

Internal code : 23A19-ZAA01
Customer identification : Sapin baumier Lot:EAB224225CA55522B
Type : Essential oil
Source : *Abies balsamea* ct. Eastern / Low thymol
Customer : ZAYAT AROMA

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 : Candide Morin, analyste
Analysis date : January 31, 2023

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Notes: This report may not be published, including online, without the written consent from Laboratoire PhytoChemia.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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PHYSICOCHEMICAL DATA

Physical aspect: Clear liquid
Refractive index: 1.4742 ± 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
Isovaleral	tr	Aliphatic aldehyde
Toluene	0.01	Simple phenolic
Unknown	0.01	Unknown
Hexanal	tr	Aliphatic aldehyde
Octane	tr	Alkane
(3Z)-Hexenol	0.01	Aliphatic alcohol
Hexanol	tr	Aliphatic alcohol
Santene	1.29	Normonoterpene
Styrene	0.01	Simple phenolic
Unknown	0.02	Normonoterpene
Bornylene	0.02	Monoterpene
Tricyclene	0.70	Monoterpene
α-Thujene	0.15	Monoterpene
α-Pinene	17.75	Monoterpene
Camphene	4.69	Monoterpene
α-Fenchene	0.10	Monoterpene
Thuja-2,4(10)-diene	0.06	Monoterpene
3,7,7-Trimethylcyclohepta-1,3,5-triene	0.05	Monoterpene
β-Pinene	32.24	Monoterpene
Sabinene	tr	Monoterpene
Unknown	0.01	Monoterpene
Myrcene	2.18	Monoterpene
2-Carene	0.01	Monoterpene
Pseudolimonene	0.02	Monoterpene
α-Phellandrene	0.21	Monoterpene
Δ3-Carene	10.56	Monoterpene
α-Terpinene	0.20	Monoterpene
Carvomenthene	0.03	Aliphatic alcohol
para-Cymene	0.19	Monoterpene
Limonene	12.38	Monoterpene
β-Phellandrene	4.93	Monoterpene
(Z)-β-Ocimene	0.01	Monoterpene
(E)-β-Ocimene	0.01	Monoterpene
γ-Terpinene	0.29	Monoterpene
Unknown	0.01	Oxygenated monoterpene
meta-Cymenene	0.01	Monoterpene
Fenchone	0.12	Monoterpenic ketone
Isoterpinolene	0.04	Monoterpene
Terpinolene	1.08	Monoterpene
para-Cymenene	0.09	Monoterpene
Unknown	0.07	Unknown
Linalool	0.02	Monoterpenic alcohol
endo-Fenchol	0.13	Monoterpenic alcohol
cis-para-Menth-2-en-1-ol	0.03	Monoterpenic alcohol
α-Campholenal	0.03	Monoterpenic aldehyde

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Nopinone	0.02	Normonoterpenic ketone
trans-Pinocarveol	0.13	Monoterpenic alcohol
Camphor	0.23	Monoterpenic ketone
trans-para-Menth-2-en-1-ol	0.02	Monoterpenic alcohol
Camphene hydrate	0.07	Monoterpenic alcohol
meta-Mentha-4,6-dien-8-ol	0.02	Monoterpenic alcohol
Isoborneol	0.05	Monoterpenic alcohol
Pinocarvone	0.04	Monoterpenic ketone
Borneol	0.73	Monoterpenic alcohol
α-Phellandren-8-ol	0.04	Monoterpenic alcohol
Isopinocamphone	0.05	Monoterpenic ketone
Terpinen-4-ol	0.24	Monoterpenic alcohol
Cryptone	0.02	Normonoterpenic ketone
para-Cymen-8-ol	0.02	Monoterpenic alcohol
Myrtenal	0.02	Monoterpenic aldehyde
α-Terpineol	0.88	Monoterpenic alcohol
Myrtenol	0.10	Monoterpenic alcohol
Methylchavicol	0.01	Phenylpropanoid
Verbenone	0.04	Monoterpenic ketone
Unknown	0.02	Unknown
endo-Fenchyl acetate	0.06	Monoterpenic ester
Thymol methyl ether	0.02	Monoterpenic ether
Citronellol	0.03	Monoterpenic alcohol
Piperitone	0.09	Monoterpenic ketone
Phellandral	0.03	Monoterpenic aldehyde
Bornyl acetate	4.43	Monoterpenic ester
Isobornyl acetate	0.02	Monoterpenic ester
2-Undecanone	0.01	Aliphatic ketone
Thymol	0.04	Monoterpenic alcohol
Myrtenyl acetate	0.01	Monoterpenic ester
Unknown	0.02	Unknown
α-Longipinene	0.09	Sesquiterpene
Citronellyl acetate	0.04	Monoterpenic ester
Longicyclene	0.03	Sesquiterpene
α-Ylangene	0.03	Sesquiterpene
α-Copaene	0.02	Sesquiterpene
β-Bourbonene	0.01	Sesquiterpene
Geranyl acetate	0.06	Monoterpenic ester
Sativene	0.02	Sesquiterpene
β-Longipinene	0.03	Sesquiterpene
Longifolene	0.42	Sesquiterpene
Methyleugenol	0.01	Phenylpropanoid
β-Caryophyllene	0.17	Sesquiterpene
trans-α-Bergamotene	0.03	Sesquiterpene
α-Humulene	0.08	Sesquiterpene
(*E*)-β-Farnesene	0.04	Sesquiterpene
γ-Muurolene	0.01	Sesquiterpene
Germacrene D	0.03	Sesquiterpene
γ-Curcumene	0.03	Sesquiterpene
β-Selinene	0.03	Sesquiterpene
β-Himachalene	0.05	Sesquiterpene
α-Muurolene	0.02	Sesquiterpene

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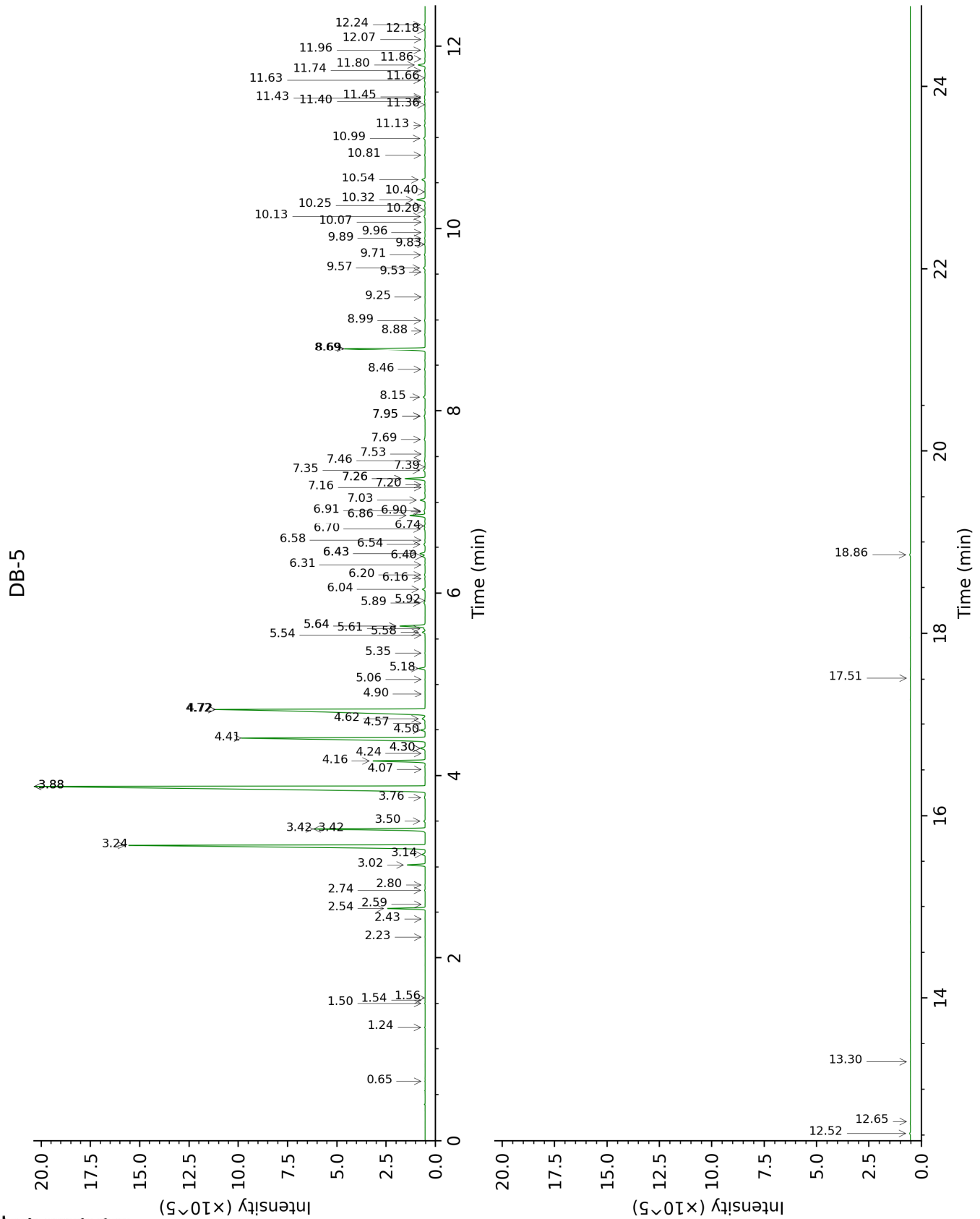|		
(*Z*)-α-Bisabolene	0.04	Sesquiterpene
β-Bisabolene	0.36	Sesquiterpene
γ-Cadinene	0.02	Sesquiterpene
δ-Cadinene	0.06	Sesquiterpene
(*E*)-γ-Bisabolene	0.02	Sesquiterpene
α-Calacorene	0.02	Sesquiterpene
(*E*)-α-Bisabolene	0.05	Sesquiterpene
(*E*)-Nerolidol	0.04	Sesquiterpenic alcohol
Caryophyllene oxide	0.01	Sesquiterpenic ether
Unknown	0.01	Oxygenated sesquiterpene
18-Norabieta-8,11,13-triene?	0.02	Norditerpene
(*Z*)-Abienol	0.05	Diterpenic alcohol
Consolidated total	**99.20%**	

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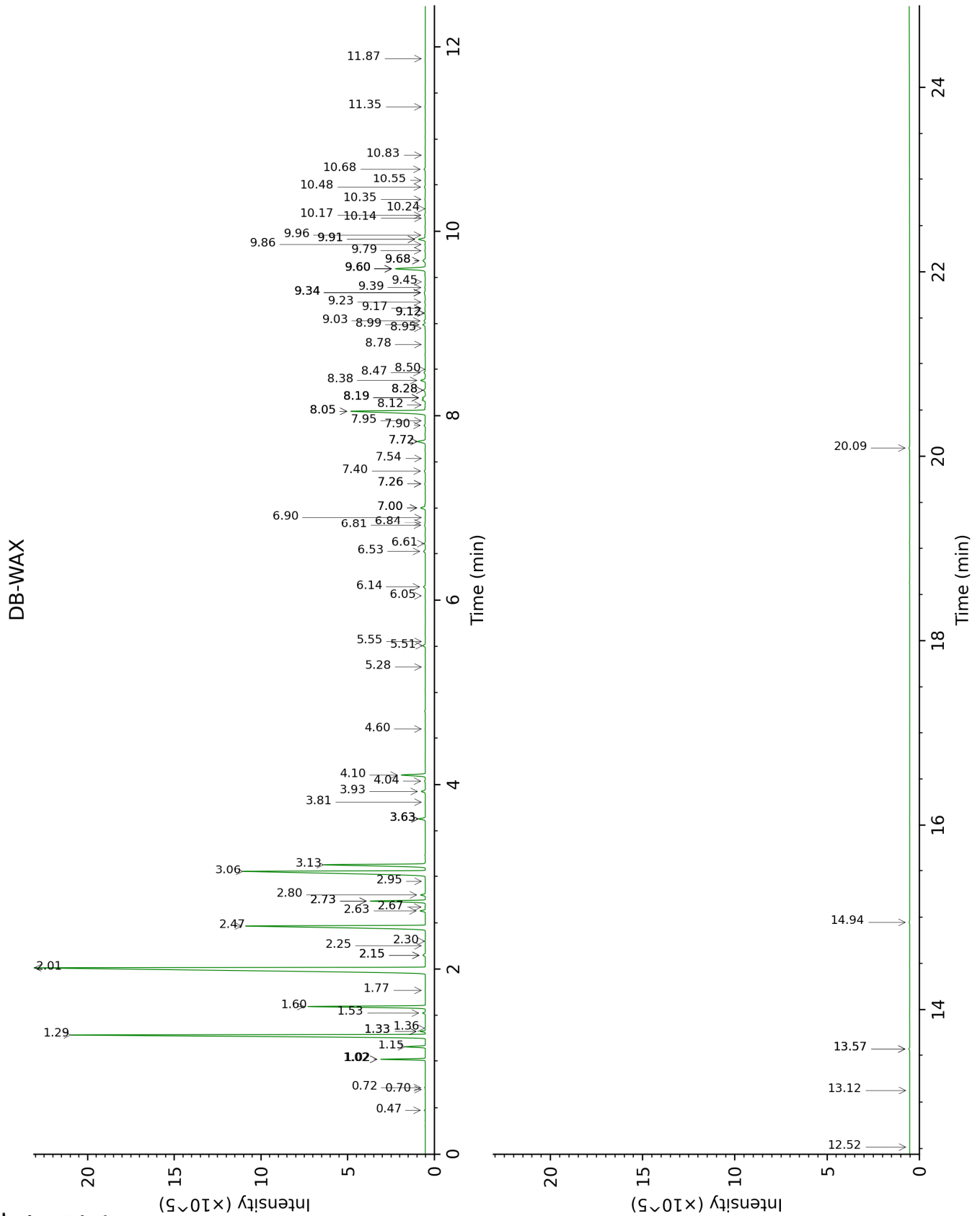
Note: no correction factor was applied

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

Chromatogram with peaks labeled:
0.65, 1.24, 1.50, 1.54, 1.56, 2.23, 2.43, 2.54, 2.59, 2.74, 2.80, 3.02, 3.14, 3.24, 3.42, 3.42, 3.50, 3.76, 3.88, 4.07, 4.16, 4.24, 4.30, 4.41, 4.50, 4.57, 4.62, 4.72, 4.90, 5.06, 5.18, 5.35, 5.54, 5.58, 5.61, 5.64, 5.89, 5.92, 6.04, 6.16, 6.20, 6.31, 6.40, 6.43, 6.54, 6.58, 6.70, 6.74, 6.86, 6.90, 6.91, 7.03, 7.16, 7.20, 7.26, 7.35, 7.39, 7.46, 7.53, 7.69, 7.95, 8.15, 8.46, 8.69, 8.88, 8.99, 9.25, 9.53, 9.57, 9.71, 9.83, 9.89, 9.96, 10.07, 10.13, 10.20, 10.25, 10.32, 10.40, 10.54, 10.81, 10.99, 11.13, 11.36, 11.40, 11.43, 11.45, 11.63, 11.66, 11.74, 11.80, 11.86, 11.96, 12.07, 12.18, 12.24

Time (min)
Intensity (×10^5)

Second chromatogram peaks labeled:
12.52, 12.65, 13.30, 17.51, 18.86

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	%
Isovaleral	0.65	640	tr	0.70	880	tr
Toluene	1.24	758	0.01	1.36	1000	0.01
Unknown [m/z 56, 45 (99), 41 (24), 84 (24), 69 (19), 43 (17)...]	1.50	794	0.01	0.72	888	0.02
Hexanal	1.54	799	tr	1.77	1043	0.01
Octane	1.56	802	tr	0.47	782	0.02
(3Z)-Hexenol	2.23	857	0.01	5.55	1344	tr
Hexanol	2.43	873	tr	5.28	1324	0.01
Santene	2.54	882	1.29	1.02*	945	1.30
Styrene	2.59	886	0.01	3.63*	1205	0.29
Unknown [m/z 79, 93 (66), 94 (52), 91 (39), 77 (37), 122 (31)]	2.74	899	0.02	1.33*	997	0.16
Bornylene	2.80	903	0.02	1.02*	945	[1.30]
Tricyclene	3.02	918	0.70	1.15	969	0.69
α-Thujene	3.14	926	0.15	1.33*	997	[0.16]
α-Pinene	3.24	932	17.75	1.29	993	17.76
Camphene	3.42*	944	4.81	1.60	1025	4.69
α-Fenchene	3.42*	944	[4.81]	1.53	1017	0.10
Thuja-2,4(10)-diene	3.50	950	0.06	2.15*	1082	0.13
3,7,7-Trimethylcyclohepta-1,3,5-triene	3.76	966	0.05	2.74*	1133	2.22
β-Pinene	3.88*	974	32.25	2.01	1068	32.24
Sabinene	3.88*	974	[32.25]	2.15*	1082	[0.13]
Unknown [m/z 91, 119 (65), 109 (51), 134 (47)]	4.07	987	0.01	2.95	1150	0.01
Myrcene	4.16	993	2.18	2.74*	1133	[2.22]
2-Carene	4.24	998	0.01	2.25	1093	0.01
Pseudolimonene	4.30*	1002	0.25	2.67	1127	0.02
α-Phellandrene	4.30*	1002	[0.25]	2.63	1124	0.21
Δ3-Carene	4.41	1009	10.56	2.47	1111	10.56
α-Terpinene	4.50	1014	0.20	2.80	1138	0.19
Carvomenthene	4.57	1019	0.03	2.30	1097	0.02
para-Cymene	4.62	1022	0.19	3.93	1228	0.18
Limonene	4.72*	1028	17.26	3.06	1159	12.38
β-Phellandrene	4.72*	1028	[17.26]	3.14	1165	4.93
(Z)-β-Ocimene	4.90	1039	0.01	3.63*	1205	[0.29]
(E)-β-Ocimene	5.06	1049	0.01	3.81	1219	0.01
γ-Terpinene	5.18	1057	0.29	3.63*	1205	[0.29]
Unknown [m/z 79, 93 (60), 43 (40), 94 (35), 137 (33), 77 (26), 91 (20), 152 (18)]	5.35	1067	0.01	4.60	1279	0.01
meta-Cymenene	5.54	1079	0.01	6.05	1380	0.01
Fenchone	5.58	1081	0.12	5.51	1341	0.12

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Compound	RT	RI	%	RT2	RI2	%2
Isoterpinolene	5.61†	1084	1.23	4.04	1236	0.04
Terpinolene	5.64*†	1086	[1.23]	4.10	1241	1.08
para-Cymenene	5.64*†	1086	[1.23]	6.14	1387	0.09
Unknown [m/z 79, 94 (87), 77 (25), 91 (21), 93 (16), 95 (12), 138 (8)]	5.89	1101	0.07			
Linalool	5.92	1103	0.02	7.90	1518	0.06
endo-Fenchol	6.04	1111	0.13	8.19*†	1541	0.30
cis-para-Menth-2-en-1-ol	6.16	1118	0.03	7.95	1522	0.03
α-Campholenal	6.20	1121	0.03	6.81	1436	0.05
Nopinone	6.31	1128	0.02	8.05*	1530	4.45
trans-Pinocarveol	6.40†	1134	0.38	8.99	1603	0.13
Camphor	6.43*†	1136	[0.38]	7.00*	1450	0.24
trans-para-Menth-2-en-1-ol	6.43*†	1136	[0.38]	8.78	1586	0.02
Camphene hydrate	6.54	1142	0.07	8.28*	1547	0.11
meta-Mentha-4,6-dien-8-ol	6.58	1145	0.02	9.12*	1613	0.04
Isoborneol	6.70	1153	0.05	9.17	1618	0.04
Pinocarvone	6.74	1155	0.04	7.72*	1504	0.44
Borneol	6.86	1162	0.73	9.60*	1652	1.69
α-Phellandren-8-ol	6.90†	1165	0.09	9.91*	1678	0.36
Isopinocamphone	6.91†	1166	[0.09]	7.40	1480	0.05
Terpinen-4-ol	7.03	1173	0.24	8.38	1556	0.25
Cryptone	7.16	1182	0.02	8.95	1600	0.03
para-Cymen-8-ol	7.20	1184	0.02	11.35	1800	0.02
Myrtenal	7.26*	1188	0.98	8.50	1565	0.02
α-Terpineol	7.26*	1188	[0.98]	9.60*	1652	[1.69]
Myrtenol	7.35	1194	0.10	10.68	1742	0.07
Methylchavicol	7.39	1196	0.01	9.12*	1613	[0.04]
Verbenone	7.46	1200	0.04	9.39	1636	0.04
Unknown [m/z 93, 121 (98), 79 (64), 91 (41), 77 (35), 124 (24)...]	7.53	1205	0.02	10.83	1755	0.02
endo-Fenchyl acetate	7.69	1216	0.06	6.61	1421	0.04
Thymol methyl ether	7.94*	1233	0.05	8.28*	1547	[0.11]
Citronellol	7.94*	1233	[0.05]	10.55	1731	0.03
Piperitone	8.15	1247	0.09	9.68*	1659	0.16
Phellandral	8.46	1267	0.03	9.79	1668	0.04
Bornyl acetate	8.69*	1282	4.49	8.05*	1530	[4.45]
Isobornyl acetate	8.69*	1282	[4.49]	8.12	1535	0.02
2-Undecanone	8.88	1295	0.01	8.47	1562	0.07
Thymol	9.00	1303	0.04	14.94	2134	0.03
Myrtenyl acetate	9.25	1321	0.01	9.34*	1631	0.11
Unknown [m/z 121, 93 (84), 43 (81), 79 (48), 117 (40), 56 (37)...]	9.53	1340	0.02			

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Compound	R.T.	R.I.	%	R.T.	R.I.	%
α-Longipinene	9.57	1343	0.09	6.53	1415	0.10
Citronellyl acetate	9.71	1353	0.04	9.24	1623	0.04
Longicyclene	9.83	1362	0.03	6.90	1443	0.01
α-Ylangene	9.90	1366	0.03	6.84	1438	0.02
α-Copaene	9.96	1370	0.02	7.00*	1450	[0.24]
β-Bourbonene	10.07	1378	0.01	7.26*	1470	0.03
Geranyl acetate	10.13	1383	0.06	10.34	1714	0.04
Sativene	10.20	1388	0.02	7.26*	1470	[0.03]
β-Longipinene	10.25	1391	0.03	7.54	1490	0.01
Longifolene	10.32	1396	0.42	7.72*	1504	[0.44]
Methyleugenol	10.40	1402	0.01	13.12	1959	0.01
β-Caryophyllene	10.54	1412	0.17	8.19*†	1541	[0.30]
trans-α-Bergamotene	10.81	1432	0.03	8.19*†	1541	[0.30]
α-Humulene	10.99	1446	0.08	9.03	1607	0.07
(*E*)-β-Farnesene	11.14	1456	0.04	9.34*	1631	[0.11]
γ-Muurolene	11.36	1473	0.01	9.34*	1631	[0.11]
Germacrene D	11.40	1476	0.03	9.60*	1652	[1.69]
γ-Curcumene	11.43†	1478	0.06	9.45	1641	0.03
β-Selinene	11.45†	1479	[0.06]	9.68*	1659	[0.16]
β-Himachalene	11.63	1493	0.05	9.60*	1652	[1.69]
α-Muurolene	11.66	1495	0.02	9.86	1674	0.03
(*Z*)-α-Bisabolene	11.74	1501	0.04	9.96	1682	0.05
β-Bisabolene	11.80	1505	0.36	9.91*	1678	[0.36]
γ-Cadinene	11.86	1510	0.02	10.14	1697	0.02
δ-Cadinene	11.96	1518	0.06	10.17	1699	0.04
(*E*)-γ-Bisabolene	12.08	1527	0.02	10.24	1705	0.01
α-Calacorene	12.18	1535	0.02	11.87	1845	0.01
(*E*)-α-Bisabolene	12.24	1540	0.05	10.48	1725	0.05
(*E*)-Nerolidol	12.52	1562	0.04	13.57*	2000	0.04
Caryophyllene oxide	12.65	1572	0.01	12.52	1903	0.01
Unknown [m/z 41, 91 (78), 67 (76), 119 (70), 55 (61)... 220 (7)]	13.30	1624	0.01	13.57*	2000	[0.04]
18-Norabieta-8,11,13-triene?	17.51	1997	0.02			
(*Z*)-Abienol	18.86	2132	0.05	20.09	2699	0.04
Total identified		**99.18%**			**99.09%**	
Total reported		**99.35%**			**99.14%**	

*: 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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