

**Date :** February 18, 2019

**CERTIFICATE OF ANALYSIS – GC PROFILING**

**SAMPLE IDENTIFICATION**

**Internal code :** 19B15-PTH05-1-SCC

**Customer identification :** Juniper Berry - Hungary - J20106811R

**Type :** Essential oil

**Source :** *Juniperus communis*

**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 :** February 18, 2019

Checked and approved by :

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Alexis St-Gelais, M. Sc., chimiste 2013-174

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#### PHYSICOCHEMICAL DATA

**Physical aspect:** Faintly yellow liquid

**Refractive index:** 1.4748 ± 0.0003 (20 °C)

#### ISO 8897:2010 - OIL OF JUNIPER BERRY

Compound	Min. %	Max. %	Observed %	Complies?
δ-Cadinene	1.0	3.5	0.9	No
Germacrene D	1.0	5.0	2.8	Yes
α-Humulene	1.0	4.0	2.8	Yes
β-Caryophyllene	1.5	5.0	3.1	Yes
Bornyl acetate		0.6	0.1	Yes
Terpinen-4-ol	1.0	6.0	3.6	Yes
Limonene	2.0	8.0	4.8	Yes
Myrcene	3.0	22.0	9.7	Yes
β-Pinene	1.0	12.0	7.7	Yes
Sabinene	4.0	20.0	9.4	Yes
α-Pinene	25.0	45.0	37.3	Yes
<b>Refractive index</b>	1.4700	1.4830	1.4748	Yes

#### CONCLUSION

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

## ANALYSIS SUMMARY

Identification	DB-5 (%)	DB-WAX (%)	Classe
Hexanal	0.01		Aliphatic aldehyde
(2E)-Hexenal	tr	0.01*	Aliphatic aldehyde
Tricyclene	0.08	0.08	Monoterpene
$\alpha$ -Thujene	0.94	0.99	Monoterpene
$\alpha$ -Pinene	37.33	37.07	Monoterpene
$\alpha$ -Fenchene	0.24*	0.03	Monoterpene
Camphene	[0.24]*	0.21	Monoterpene
Thuja-2,4(10)-diene	0.03	9.44*	Monoterpene
meta-Cymene	0.02	9.64*	Monoterpene
Sabinene	17.27	[9.44]*	Monoterpene
$\beta$ -Pinene	[17.27]	7.70	Monoterpene
Unknown	0.10	0.08	Monoterpene
Octen-3-ol	0.02	0.01	Aliphatic alcohol
6-Methyl-5-hepten-2-one	0.04		Aliphatic ketone
Myrcene	9.72	[9.64]*	Monoterpene
2-Carene	0.05	0.04	Monoterpene
$\alpha$ -Phellandrene	0.18*	0.13	Monoterpene
Pseudolimonene	[0.18]*	0.16	Monoterpene
Menthatriene isomer I	0.16	[0.01]*	Monoterpene
$\Delta^3$ -Carene	0.11	0.10	Monoterpene
$\alpha$ -Terpinene	0.81	0.80	Monoterpene
ortho-Cymene	0.03	3.40*	Simple phenolic
para-Cymene	3.37	[3.40]*	Monoterpene
Limonene	5.15*	4.75	Monoterpene
$\beta$ -Phellandrene	[5.15]*	0.35*	Monoterpene
1,8-Cineole	[5.15]*	[0.35]*	Monoterpenic ether
(E)- $\beta$ -Ocimene	0.02	0.02	Monoterpene
$\gamma$ -Terpinene	2.60	2.60	Monoterpene
cis-Sabinene hydrate	0.02	0.03	Monoterpenic alcohol
Unknown	0.02	0.01	Oxygenated monoterpene
cis-Linalool oxide (fur.)	0.01	0.01	Monoterpenic alcohol
Fenchone	0.01	0.01	Aliphatic alcohol
Terpinolene	0.84*	0.76	Monoterpene
para-Cymenene	[0.84]*	0.01	Monoterpene
6,7-Epoxymyrcene	0.01*	0.01	Monoterpenic ether
trans-Sabinene hydrate	[0.01]*	0.05	Monoterpenic alcohol
Linalool	0.05*	0.05	Monoterpenic alcohol
Perillene	[0.05]*	0.02	Monoterpenic ether
Nonanal	0.01	0.01	Aliphatic aldehyde
endo-Fenchol	0.02	0.03	Monoterpenic alcohol
cis-para-Menth-2-en-1-ol	0.04	0.02	Monoterpenic alcohol
$\alpha$ -Campholenal	0.03	0.02	Monoterpenic aldehyde
trans-Pinocarveol	0.04	0.14	Monoterpenic alcohol
Camphor	0.04*	0.03*	Monoterpenic ketone
cis-Verbenol	[0.04]*	0.01	Monoterpenic alcohol
trans-Verbenol	0.02*	0.02	Monoterpenic alcohol
Camphene hydrate	[0.02]*	3.73*	Monoterpenic alcohol
meta-Mentha-4,6-dien-8-ol	0.01	0.01	Monoterpenic alcohol

Citronellal	0.02	0.01	Monoterpenic aldehyde
Borneol	0.04	0.26*	Monoterpenic alcohol
$\alpha$ -Phellandren-8-ol	0.02	0.02	Monoterpenic alcohol
Terpinen-4-ol	3.59	3.62*	Monoterpenic alcohol
para-Cymen-8-ol	0.02	0.02	Monoterpenic alcohol
$\alpha$ -Terpineol	0.19*	[0.26]*	Monoterpenic alcohol
Myrtenal	[0.19]*	0.02	Monoterpenic aldehyde
Myrtenol	0.04	0.02	Monoterpenic alcohol
Verbenone	0.03	0.23*	Monoterpenic ketone
endo-Fenchyl acetate	0.02*	0.20*	Monoterpenic ester
<i>trans</i> -Carveol	[0.02]*	0.01	Monoterpenic alcohol
Citronellol	0.03	0.06*	Monoterpenic alcohol
Thymol methyl ether	0.02*	[3.73]*	Monoterpenic ether
Unknown	[0.02]*	0.01	Oxygenated monoterpene
Carvone	0.01	0.19*	Monoterpenic ketone
Carvacrol methyl ether	0.01	[3.62]*	Monoterpenic ether
Piperitone	0.02	2.79*	Monoterpenic ketone
Geraniol	0.02	0.03	Monoterpenic alcohol
Methyl citronellate	0.03	0.17*	Monoterpenic ester
Geranial	0.02	0.41*	Monoterpenic aldehyde
Decanol	0.01	[0.06]*	Aliphatic alcohol
Bornyl acetate	0.13	[0.17]*	Monoterpenic ester
2-Undecanone	0.03	0.09*	Aliphatic ketone
Thymol	0.01	0.10*	Monoterpenic alcohol
Myrtenyl acetate	0.04*	0.05	Monoterpenic ester
Bicycloelemene analog	[0.04]*	[0.20]*	Sesquiterpene
Terpinyl acetate analog	0.04	[0.23]*	Monoterpenic ester
$\alpha$ -Terpinyl acetate	0.21*	0.05	Monoterpenic ester
$\alpha$ -Cubebene	[0.21]*	[0.20]*	Sesquiterpene
Citronellyl acetate	0.03	0.03	Monoterpenic ester
$\alpha$ -Ylangene	0.02	[0.03]*	Sesquiterpene
$\alpha$ -Copaene	0.12	0.13	Sesquiterpene
<i>cis</i> - $\beta$ -Elemene	0.02	0.02	Sesquiterpene
$\beta$ -Cubebene	0.03	0.04	Sesquiterpene
$\beta$ -Elemene	0.56	[3.73]*	Sesquiterpene
Longifolene	0.07*	0.04	Sesquiterpene
Sibirene	[0.07]*	0.02	Sesquiterpene
$\alpha$ -Gurjunene	0.03	0.03	Sesquiterpene
$\beta$ -Caryophyllene	3.10	[3.73]*	Sesquiterpene
<i>cis</i> -Thujopsene	0.07*	0.02	Sesquiterpene
$\beta$ -Copaene	[0.07]*	[3.73]*	Sesquiterpene
$\gamma$ -Elemene	0.23	0.27	Sesquiterpene
Aromadendrene	0.04	[0.09]*	Sesquiterpene
$\alpha$ -Himachalene	0.02	0.01	Sesquiterpene
<i>cis</i> - $\beta$ -Bergamotene?	2.94		Sesquiterpene
$\alpha$ -Humulene	[2.94]	2.85*	Sesquiterpene
allo-Aromadendrene	0.02	0.03	Sesquiterpene
( <i>E</i> )- $\beta$ -Farnesene	0.24*	[0.23]*	Sesquiterpene
$\beta$ -Acoradiene	[0.24]*	0.04	Sesquiterpene
10-epi- $\beta$ -Acoradiene	0.01	[0.23]*	Sesquiterpene
<i>trans</i> -Cadina-1(6),4-diene	0.07	[2.85]*	Sesquiterpene
$\gamma$ -Murolene	0.23	0.27	Sesquiterpene

Germacrene D	2.78	[2.79]*	Sesquiterpene
$\beta$ -Selinene	0.16	0.21	Sesquiterpene
$\gamma$ -Amorphene	0.05	[2.79]*	Sesquiterpene
Bicyclogermacrene	0.40*	[0.41]*	Sesquiterpene
$\alpha$ -Selinene	[0.40]*	[0.19]*	Sesquiterpene
$\alpha$ -Muurolene	0.36	[0.41]*	Sesquiterpene
Germacrene A	[0.36]	0.13	Sesquiterpene
$\gamma$ -Cadinene	0.31	0.26*	Sesquiterpene
<i>trans</i> -Calamenene	0.89*	0.01	Sesquiterpene
$\delta$ -Cadinene	[0.89]*	0.87	Sesquiterpene
<i>trans</i> -Cadina-1,4-diene	0.12	0.16*	Sesquiterpene
( <i>E</i> )- $\gamma$ -Bisabolene	0.10*	[0.26]*	Sesquiterpene
Selina-4(15),7(11)-diene	[0.10]*	0.05	Sesquiterpene
$\alpha$ -Cadinene	0.10*	0.07	Sesquiterpene
$\alpha$ -Calacorene	[0.10]*	0.02	Sesquiterpene
Selina-3,7(11)-diene	[0.10]*	[0.16]*	Sesquiterpene
Germacrene B	1.16	1.16	Sesquiterpene
( <i>E</i> )-Nerolidol	0.02	0.07*	Sesquiterpenic alcohol
Caryophyllenyl alcohol	0.02	0.01	Sesquiterpenic alcohol
Spathulenol	0.07	0.07	Sesquiterpenic alcohol
Caryophyllene oxide	0.03*	0.02	Sesquiterpenic ether
Caryophyllene oxide isomer	[0.03]*		Sesquiterpenic ether
Unknown	0.03		Oxygenated sesquiterpene
$\alpha$ -Cedrol	0.01	0.02	Sesquiterpenic alcohol
Humulene epoxide II	0.03	0.02	Sesquiterpenic ether
10- <i>epi</i> -Cubenol	0.03	[0.07]*	Sesquiterpenic alcohol
$\tau$ -Cadinol	0.20*	0.11	Sesquiterpenic alcohol
$\tau$ -Muurolol	[0.20]*	[0.10]*	Sesquiterpenic alcohol
$\alpha$ -Muurolol	0.06	0.04	Sesquiterpenic alcohol
Unknown	0.04		Oxygenated sesquiterpene
$\alpha$ -Cadinol	0.18	0.28*	Sesquiterpenic alcohol
(3 <i>Z</i> )-Caryophylla-3,8(13)-dien-5 $\beta$ -ol	0.02	0.04	Sesquiterpenic alcohol
<i>epi</i> - $\alpha$ -Bisabolol	0.01	0.01	Sesquiterpenic alcohol
<i>meta</i> -Camphorene	0.11	[0.28]*	Diterpene
<i>para</i> -Camphorene	0.04	0.03	Diterpene
<i>ar</i> -Abietatriene	0.02	0.03	Diterpene
Sandaracopimarinal?	0.02		Diterpenic aldehyde
<b>Total identified</b>	<b>99.03%</b>	<b>98.33%</b>	

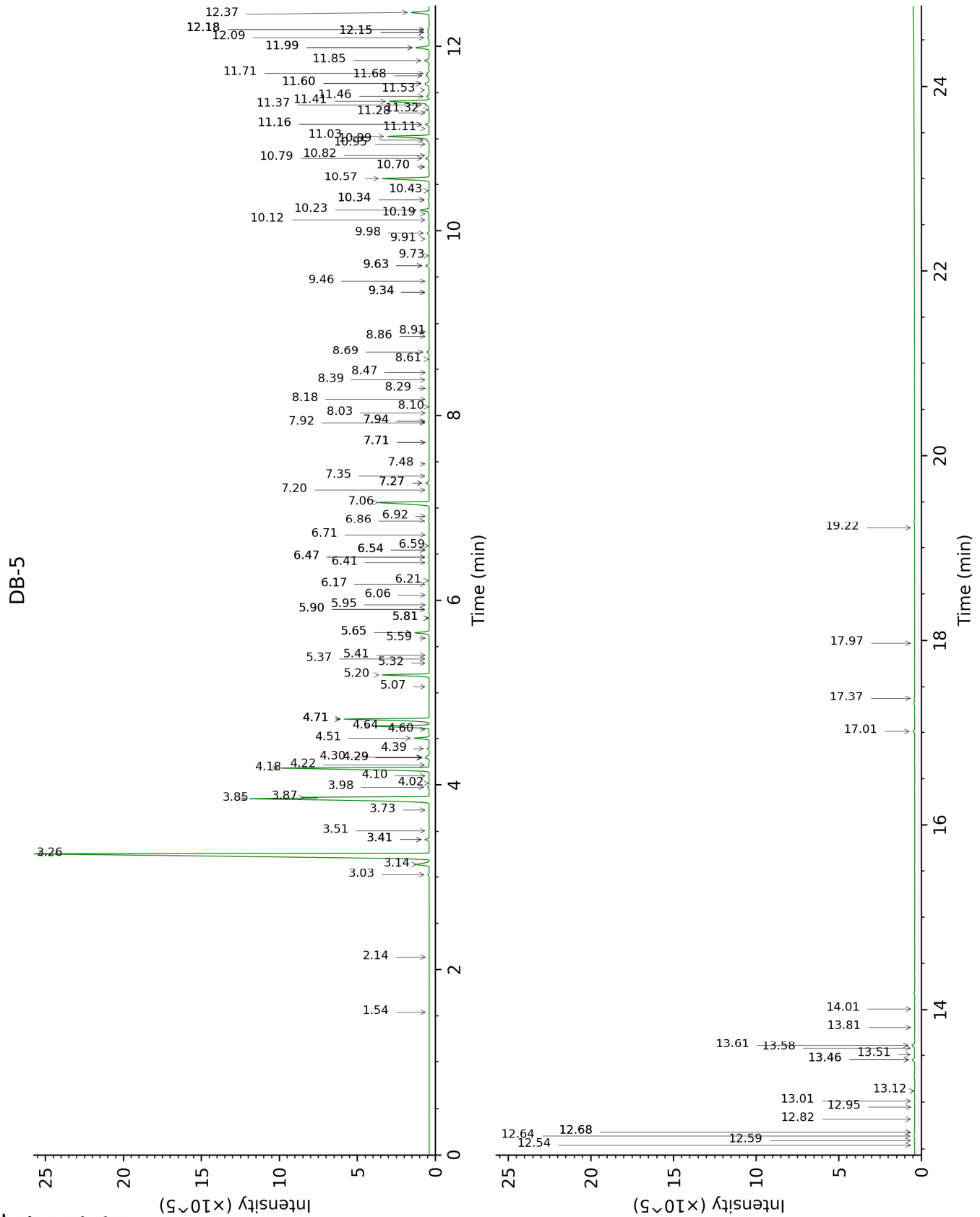
\*: Two or more compounds are coeluting on this column

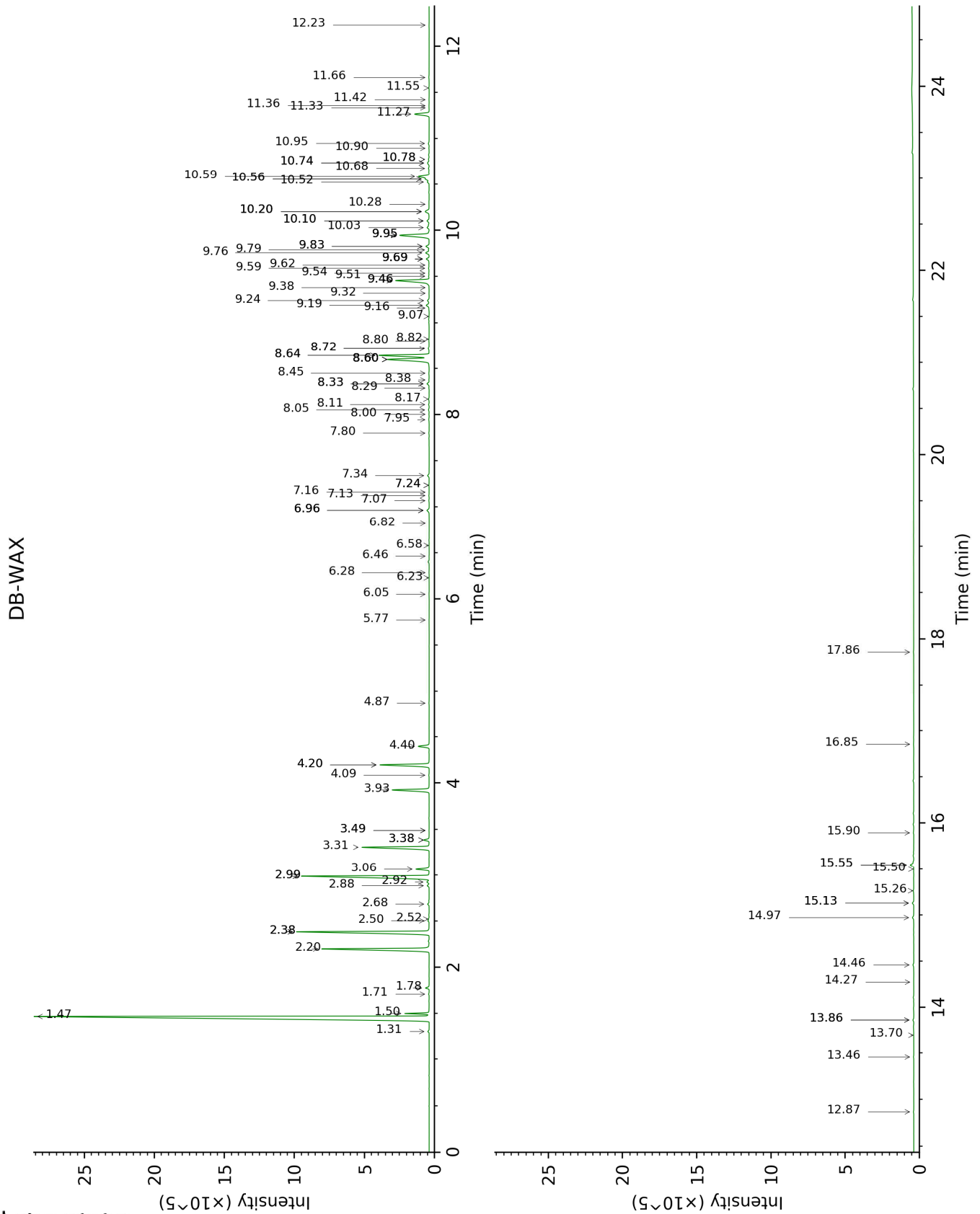
[xx]: Duplicate percentage due to coelutions, not taken account in the identified total

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	%
Hexanal	1.54	797	0.01			
(2E)-Hexenal	2.14	848	tr	3.49*	1176	0.01
Tricyclene	3.03	917	0.08	1.31	977	0.08
$\alpha$ -Thujene	3.14	925	0.94	1.50	1004	0.99
$\alpha$ -Pinene	3.26	932	37.33	1.47	1001	37.07
$\alpha$ -Fenchene	3.41*	942	0.24	1.71	1024	0.03
Camphene	3.41*	942	[0.24]	1.78	1030	0.21
Thuja-2,4(10)-diene	3.51	948	0.03	2.38*	1088	9.44
meta-Cymene	3.73	963	0.02	2.99*	1137	9.64
Sabinene	3.85†	971	17.27	2.38*	1088	[9.44]
$\beta$ -Pinene	3.87†	972	[17.27]	2.20	1070	7.70
Unknown [m/z 93, 79 (73), 67 (49), 95 (42), 91 (41), 121 (38)...]	3.98	979	0.10	2.50	1099	0.08
Octen-3-ol	4.02	982	0.02	6.82	1414	0.01
6-Methyl-5-hepten-2-one	4.10	987	0.04			
Myrcene	4.18	993	9.72	2.99*	1137	[9.64]
2-Carene	4.22	995	0.05	2.52	1100	0.04
$\alpha$ -Phellandrene	4.29*	1000	0.18	2.88	1128	0.13
Pseudolimonene	4.29*	1000	[0.18]	2.92	1132	0.16
Menthatriene isomer I	4.30	1000	0.16	3.49*	1176	[0.01]
$\Delta$ 3-Carene	4.39	1006	0.11	2.68	1113	0.10
$\alpha$ -Terpinene	4.51	1013	0.81	3.06	1143	0.80
ortho-Cymene	4.60	1019	0.03	4.20*	1232	3.40
para-Cymene	4.64	1021	3.37	4.20*	1232	[3.40]
Limonene	4.71*	1026	5.15	3.31	1162	4.75
$\beta$ -Phellandrene	4.71*	1026	[5.15]	3.38*	1168	0.35
1,8-Cineole	4.71*	1026	[5.15]	3.38*	1168	[0.35]
(E)- $\beta$ -Ocimene	5.07	1048	0.02	4.09	1223	0.02
$\gamma$ -Terpinene	5.20	1056	2.60	3.93	1211	2.60
cis-Sabinene hydrate	5.32	1064	0.02	7.07	1433	0.03
Unknown [m/z 79, 93 (60), 43 (40), 94 (35), 137 (33), 77 (26), 91 (20), 152 (18)]	5.37	1067	0.02	4.86	1284	0.01
cis-Linalool oxide (fur.)	5.41	1069	0.01	6.58	1396	0.01
Fenchone	5.59	1081	0.01	5.77	1336	0.01
Terpinolene	5.65*	1084	0.84	4.40	1248	0.76
para-Cymenene	5.65*	1084	[0.84]	6.46	1387	0.01
6,7-Epoxymyrcene	5.81*	1094	0.01	6.23	1370	0.01
trans-Sabinene hydrate	5.81*	1094	[0.01]	8.05	1508	0.05
Linalool	5.90*	1100	0.05	8.17	1517	0.05

Perillene	5.90*	1100	[0.05]	6.28	1374	0.02
Nonanal	5.95	1103	0.01	6.05	1357	0.01
endo-Fenchol	6.06	1110	0.02	8.45	1539	0.03
cis-para-Menth-2-en-1-ol	6.18	1118	0.04	8.29	1526	0.02
α-Campholenal	6.21	1120	0.03	7.13	1437	0.02
trans-Pinocarveol	6.41	1133	0.04	9.24	1602	0.14
Camphor	6.47*	1136	0.04	7.24*	1446	0.03
cis-Verbenol	6.47*	1136	[0.04]	9.32	1608	0.01
trans-Verbenol	6.54*	1141	0.02	9.62	1633	0.02
Camphene hydrate	6.54*	1141	[0.02]	8.60*	1551	3.73
meta-Mentha-4,6-dien-8-ol	6.59	1144	0.01	9.38	1613	0.01
Citronellal	6.71	1152	0.02	7.16	1440	0.01
Borneol	6.86	1162	0.04	9.83*	1650	0.26
α-Phellandren-8-ol	6.92	1165	0.02	10.28	1688	0.02
Terpinen-4-ol	7.06	1175	3.59	8.64*	1554	3.62
para-Cymen-8-ol	7.20	1183	0.02	11.55	1796	0.02
α-Terpineol	7.27*	1188	0.19	9.83*	1650	[0.26]
Myrtenal	7.27*	1188	[0.19]	8.80	1567	0.02
Myrtenol	7.35	1193	0.04	10.90	1740	0.02
Verbenone	7.48	1202	0.03	9.69*	1639	0.23
endo-Fenchyl acetate	7.71*	1217	0.02	6.96*	1425	0.20
trans-Carveol	7.71*	1217	[0.02]	11.42	1785	0.01
Citronellol	7.92	1232	0.03	10.78*	1729	0.06
Thymol methyl ether	7.94*	1233	0.02	8.60*	1551	[3.73]
Unknown [m/z 137, 152 (28), 43 (25), 91 (24), 109 (23), 119 (19)]	7.94*	1233	[0.02]	11.36	1779	0.01
Carvone	8.03	1239	0.01	10.10*	1673	0.19
Carvacrol methyl ether	8.10	1243	0.01	8.64*	1554	[3.62]
Piperitone	8.18	1249	0.02	9.95*	1660	2.79
Geraniol	8.30	1257	0.02	11.66	1806	0.03
Methyl citronellate	8.39	1263	0.03	8.33*	1530	0.17
Geranial	8.47	1268	0.02	10.20*	1681	0.41
Decanol	8.61	1278	0.01	10.78*	1729	[0.06]
Bornyl acetate	8.69	1283	0.13	8.33*	1530	[0.17]
2-Undecanone	8.86	1295	0.03	8.72*	1560	0.09
Thymol	8.92	1299	0.01	15.13*	2130	0.10
Myrtenyl acetate	9.34*	1325	0.04	9.59	1630	0.05
Bicycloelemene analog	9.34*	1325	[0.04]	6.96*	1425	[0.20]
Terpinyl acetate analog	9.46	1333	0.04	9.69*	1639	[0.23]
α-Terpinyl acetate	9.63*	1345	0.21	9.79	1647	0.05
α-Cubebene	9.63*	1345	[0.21]	6.96*	1425	[0.20]
Citronellyl acetate	9.73	1352	0.03	9.54	1626	0.03
α-Ylangene	9.92	1365	0.02	7.24*	1446	[0.03]
α-Copaene	9.98	1370	0.12	7.34	1453	0.13

<i>cis</i> -β-Elemene	10.12	1380	0.02	8.38	1533	0.02
β-Cubebene	10.18	1384	0.03	7.95	1499	0.04
β-Elemene	10.23	1387	0.56	8.60*	1551	[3.73]
Longifolene	10.34*	1395	0.07	8.11	1512	0.04
Sibirene	10.34*	1395	[0.07]	8.00	1504	0.02
α-Gurjunene	10.43	1402	0.03	7.80	1488	0.03
β-Caryophyllene	10.57	1412	3.10	8.60*	1551	[3.73]
<i>cis</i> -Thujopsene	10.70*	1422	0.07	8.82	1569	0.02
β-Copaene	10.70*	1422	[0.07]	8.60*	1551	[3.73]
γ-Elemene	10.79	1429	0.23	9.19	1598	0.27
Aromadendrene	10.82	1431	0.04	8.72*	1560	[0.09]
α-Himachalene	10.94	1440	0.02	9.07	1588	0.01
<i>cis</i> -β-Bergamotene?	10.99†	1443	2.94			
α-Humulene	11.03†	1446	[2.94]	9.46*	1620	2.85
allo-Aromadendrene	11.11	1452	0.02	9.16	1595	0.03
( <i>E</i> )-β-Farnesene	11.16*	1456	0.24	9.69*	1639	[0.23]
β-Acoradiene	11.16*	1456	[0.24]	9.50	1623	0.04
10- <i>epi</i> -β-Acoradiene	11.28	1465	0.01	9.69*	1639	[0.23]
<i>trans</i> -Cadina-1(6),4-diene	11.32	1468	0.07	9.46*	1620	[2.85]
γ-Murolene	11.37	1471	0.23	9.76	1644	0.27
Germacrene D	11.41	1474	2.78	9.95*	1660	[2.79]
β-Selinene	11.46	1478	0.16	10.03	1667	0.21
γ-Amorphene	11.53	1483	0.05	9.95*	1660	[2.79]
Bicyclgermacrene	11.60*	1489	0.40	10.20*	1681	[0.41]
α-Selinene	11.60*	1489	[0.40]	10.10*	1673	[0.19]
α-Murolene	11.68†	1495	0.36	10.20*	1681	[0.41]
Germacrene A	11.71†	1497	[0.36]	10.52	1708	0.13
γ-Cadinene	11.85	1507	0.31	10.56*	1710	0.26
<i>trans</i> -Calamenene	11.99*	1518	0.89	11.33	1777	0.01
δ-Cadinene	11.99*	1518	[0.89]	10.58	1713	0.87
<i>trans</i> -Cadina-1,4-diene	12.09	1527	0.12	10.74*	1726	0.16
( <i>E</i> )-γ-Bisabolene	12.15*	1531	0.10	10.56*	1710	[0.26]
Selina-4(15),7(11)-diene	12.15*	1531	[0.10]	10.68	1721	0.05
α-Cadinene	12.18*	1534	0.10	10.95	1744	0.07
α-Calacorene	12.18*	1534	[0.10]	12.23	1856	0.02
Selina-3,7(11)-diene	12.18*	1534	[0.10]	10.74*	1726	[0.16]
Germacrene B	12.37	1548	1.16	11.27	1771	1.16
( <i>E</i> )-Nerolidol	12.54	1562	0.02	13.86*	2007	0.07
Caryophyllenyl alcohol	12.59	1566	0.02	13.70	1991	0.01
Spathulenol	12.64	1570	0.07	14.46	2064	0.07
Caryophyllene oxide	12.68*	1573	0.03	12.87	1914	0.02
Caryophyllene oxide isomer	12.68*	1573	[0.03]			
Unknown [m/z 159, 83 (88), 55 (53), 93 (50), 121 (48)... 220 (9)]	12.82	1584	0.03			
α-Cedrol	12.95	1594	0.01	14.27	2047	0.02

Humulene epoxide II	13.01	1599	0.03	13.46	1969	0.02
10-epi-Cubenol	13.12	1608	0.03	13.86*	2007	[0.07]
τ-Cadinol	13.46*	1635	0.20	14.97	2114	0.11
τ-Muurolol	13.46*	1635	[0.20]	15.13*	2130	[0.10]
α-Muurolol	13.51	1640	0.06	15.26	2144	0.04
Unknown [m/z 41, 91 (96), 79 (88), 69 (82), 123 (80), 93 (80)... 220 (8)]	13.58	1646	0.04			
α-Cadinol	13.61	1648	0.18	15.55*	2172	0.28
(3Z)-Caryophylla-3,8(13)-dien-5β-ol	13.81	1665	0.02	16.85	2307	0.04
epi-α-Bisabolol	14.01	1681	0.01	15.50	2167	0.01
meta-Camphorene	17.01	1949	0.11	15.55*	2172	[0.28]
para-Camphorene	17.37	1982	0.04	15.90	2207	0.03
ar-Abietatriene	17.97	2042	0.02	17.86	2416	0.03
Sandaracopimarinal?	19.22	2168	0.02			
<b>Total identified</b>		<b>99.03%</b>			<b>98.33%</b>	
<b>Total reported</b>		<b>99.22%</b>			<b>98.43%</b>	

\*: 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