

**Date :** November 27, 2018

**CERTIFICATE OF ANALYSIS – GC PROFILING**

**SAMPLE IDENTIFICATION**

**Internal code :** 18K21-PTH06-1-CC

**Customer identification :** Caraway Seed CO2 SE-Extract - Germany - C510186R

**Type :** CO2 extract

**Source :** *Carum carvi*

**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 :** Sylvain Mercier, M. Sc., Chimiste

**Analysis date :** November 26, 2018

Checked and approved by :

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

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*PHYSICOCHEMICAL DATA*

**Physical aspect:** Light yellow liquid

**Refractive index:**  $1.4840 \pm 0.0003$  (20 °C)

*CONCLUSION*

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

## ANALYSIS SUMMARY

Identification	DB-5 (%)	DB-WAX (%)	Classe
Acetic acid	0.02	0.02	Aliphatic acid
Hexanal	tr	0.01	Aliphatic aldehyde
Heptanal	tr		Aliphatic aldehyde
Hashishene	0.01	0.04*	Monoterpene
$\alpha$ -Pinene	0.03	[0.04]*	Monoterpene
Camphene	tr	0.01	Monoterpene
Sabinene	0.06*	0.05	Monoterpene
$\beta$ -Pinene	[0.06]*	0.01	Monoterpene
Octan-3-one	tr	0.03*	Aliphatic ketone
Myrcene	0.36	0.35	Monoterpene
Octanal	0.01	0.01	Aliphatic aldehyde
para-Cymene	0.01	0.04	Monoterpene
Limonene	38.41*	38.04	Monoterpene
1,8-Cineole	[38.41]*	0.03	Monoterpenic ether
(Z)- $\beta$ -Ocimene	0.01	0.01	Monoterpene
(E)- $\beta$ -Ocimene	0.02	[0.03]*	Monoterpene
$\gamma$ -Terpinene	0.04	0.04	Monoterpene
Fenchone	tr	tr	Aliphatic alcohol
6,7-Epoxymyrcene	tr		Monoterpenic ether
Linalool	0.03	0.04	Monoterpenic alcohol
Unknown	0.01	0.01	Unknown
<i>trans</i> -para-Mentha-2,8-dien-1-ol	0.13*	0.13	Monoterpenic alcohol
Unknown	[0.13]*	0.01	Oxygenated monoterpene
<i>cis</i> -Limonene oxide	0.15	0.15	Monoterpenic ether
<i>cis</i> -para-Mentha-2,8-dien-1-ol	0.09	0.10*	Monoterpenic alcohol
<i>trans</i> -Limonene oxide	0.13	0.13	Monoterpenic ether
Unknown	0.03	0.04	Oxygenated monoterpene
<i>trans</i> -Isocarveol	0.02	0.05	Monoterpenic alcohol
$\alpha$ -Terpineol	0.10	0.11*	Monoterpenic alcohol
Unknown	0.06	0.04	Unknown
Unknown	0.06		Unknown
<i>trans</i> -Dihydrocarvone	0.12*	0.09	Monoterpenic ketone
Unknown	[0.12]*		Unknown
iso-Dihydrocarveol ?	0.02	0.01	Monoterpenic alcohol
<i>trans</i> -Carveol	0.31	0.32	Monoterpenic alcohol
<i>cis</i> -Carveol	0.08	0.16	Monoterpenic alcohol
Carvone	48.65*	48.49*	Monoterpenic ketone
Neral	[48.65]*	[0.10]*	Monoterpenic aldehyde
Isopiperitenone	0.01	0.03*	Monoterpenic ketone
Perillaldehyde	0.20	0.19	Monoterpenic aldehyde
<i>trans</i> -Carvone oxide	0.02	[0.03]*	Monoterpenic ketone
(E)-Anethole	0.05	0.05	Phenylpropanoid
Perillyl alcohol	0.01	0.01	Monoterpenic alcohol
Thymol	0.03	0.03	Monoterpenic alcohol
Carvacrol	0.01	0.02	Monoterpenic alcohol
Limonene <i>trans</i> -glycol	0.06*	0.05	Monoterpenic alcohol
<i>trans</i> -Carvyl acetate	[0.06]*	0.01	Monoterpenic ester
<i>cis</i> -Carvyl acetate	0.01	tr	Monoterpenic ester

Unknown	0.05	0.05*	Unknown
β-Bourbonene	0.01	0.01	Sesquiterpene
β-Elemene	0.02	0.02	Sesquiterpene
Unknown	0.02		Unknown
Unknown	0.02		Unknown
β-Caryophyllene	0.07	0.08	Sesquiterpene
α-Humulene	0.01	0.01	Sesquiterpene
Germacrene D	0.03	[0.11]*	Sesquiterpene
β-Selinene	0.01	[48.49]*	Sesquiterpene
α-Selinene	0.01*	[48.49]*	Sesquiterpene
Bicyclogermacrene	[0.01]*	[48.49]*	Sesquiterpene
7-epi-α-Selinene	0.01	0.01	Sesquiterpene
Salviadienol?	0.01	0.02	Sesquiterpenic alcohol
Spathulenol	0.02	0.02	Sesquiterpenic alcohol
Caryophyllene oxide	0.05*	0.05	Sesquiterpenic ether
Caryophyllene oxide isomer	[0.05]*	0.01	Sesquiterpenic ether
Salvial-4(14)-en-1-one	0.01	0.01	Aliphatic alcohol
Caryophylladienol II	0.01	[0.05]*	Sesquiterpenic alcohol
Unknown	tr		Unknown
Unknown	0.02	0.01	Oxygenated sesquiterpene
Unknown	0.01	0.01	Oxygenated sesquiterpene
(3Z)-Caryophylla-3,8(13)-dien-5β-ol	0.01	0.04	Sesquiterpenic alcohol
Germacra-4(15),5,10(14)-trien-1α-ol	0.01	0.01	Sesquiterpenic alcohol
Unknown	0.01	0.09	Lignan
Unknown	0.01		Oxygenated sesquiterpene
Unknown	0.01	0.02	Oxygenated sesquiterpene
Unknown	0.03		Unknown
Unknown	0.02	0.02	Oxygenated sesquiterpene
Phytone	0.03	0.06	Terpenic ketone
Unknown	0.01		Unknown
Methyl palmitate	0.01	0.01	Aliphatic ester
Palmitic acid	0.62	0.68	Aliphatic acid
(Z)-Falcarinol	0.01	0.01	Polyyne
Methyl linoleate	0.03	0.01	Aliphatic ester
Methyl petroselinat?	0.04		Aliphatic ester
Phytol	0.08	0.14	Diterpenic alcohol
Linoleic acid	1.34	1.53	Aliphatic acid
Oleic acid	2.48	[2.63]	Aliphatic acid
cis-Vaccenic acid?	[2.48]	2.63	Aliphatic acid
Stearic acid	1.06	1.15	Aliphatic acid
Panaxydol?	0.05		Polyyne
Panaxydol isomer?	0.05		Polyyne
Unknown	0.18		Unknown
Squalene	0.18	0.34	Triterpene
Nonacosane	0.19	0.23	Alkane
Unknown	0.38		Unknown
Unknown	[0.38]		Unknown
<b>Total identified</b>	<b>95.66%</b>	<b>95.99%</b>	

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

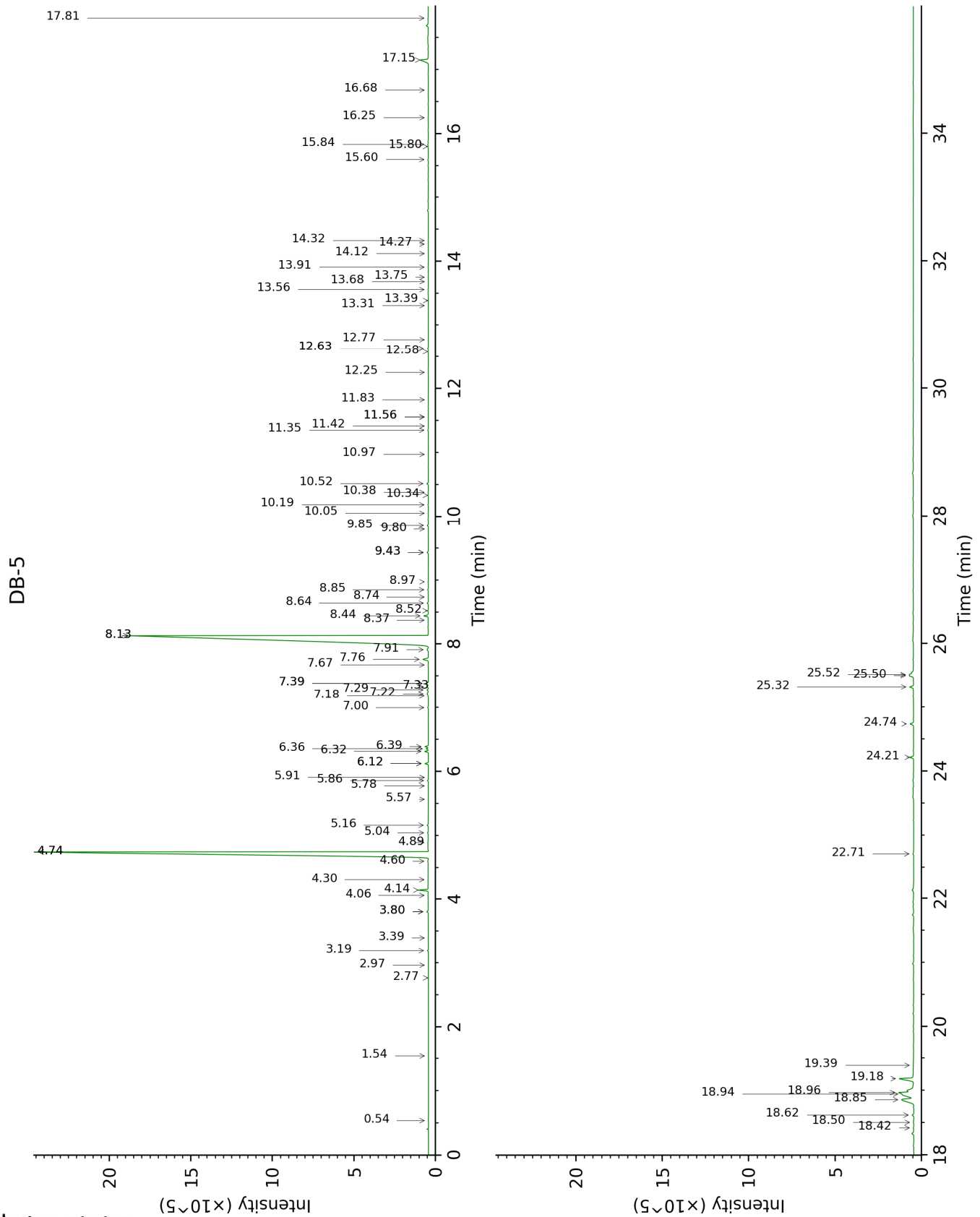
[xx]: Duplicate percentage due to coelutions, not taken account in the identified total

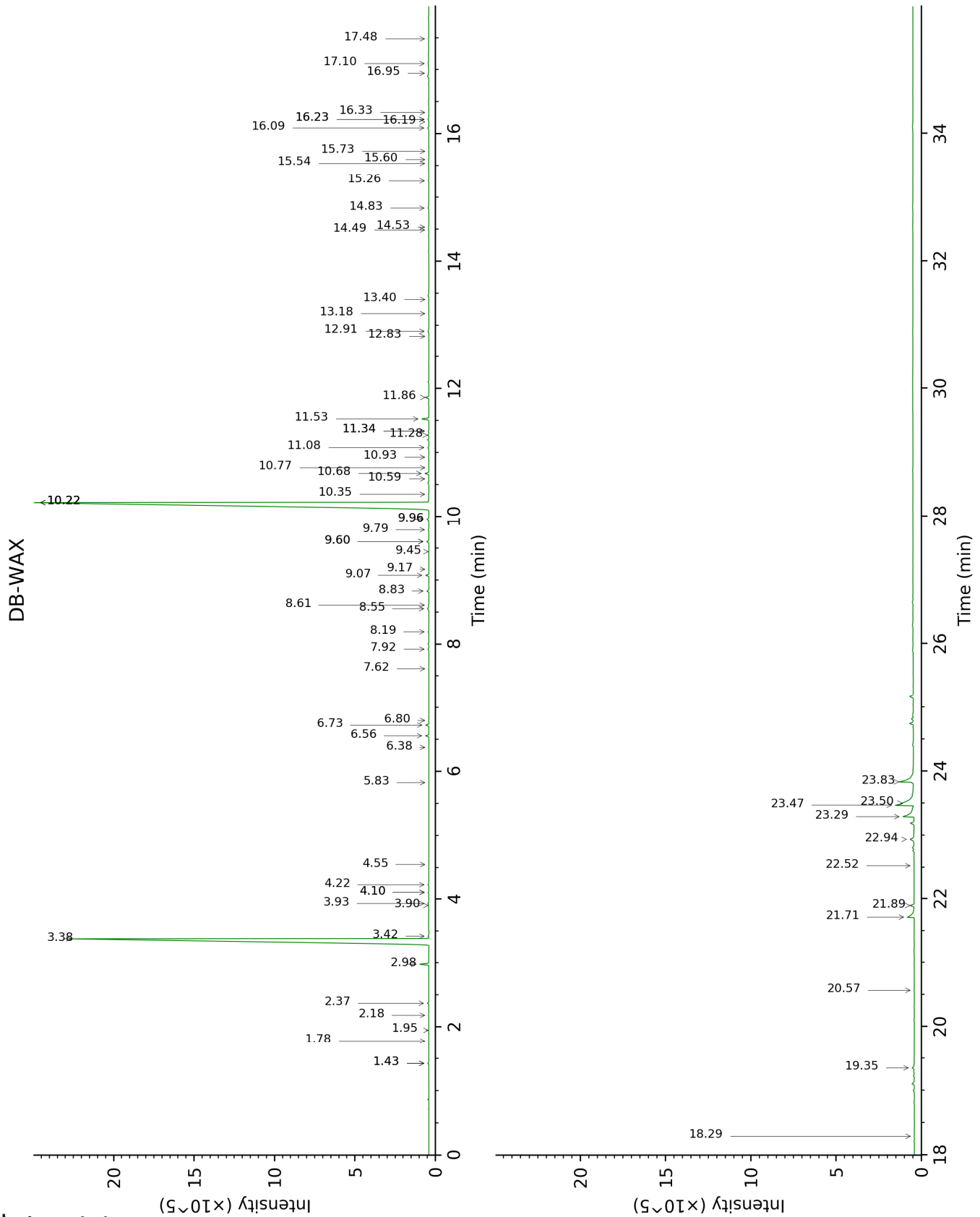
tr: The compound has been detected below 0.005% of total signal.

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	%
Acetic acid	0.54	602	0.02	6.80	1413	0.02
Hexanal	1.54	798	tr	1.95	1044	0.01
Heptanal	2.77	901	tr			
Hashishene	2.97	914	0.01	1.43*	992	0.04
$\alpha$ -Pinene	3.19	929	0.03	1.43*	992	[0.04]
Camphene	3.39	942	tr	1.78	1028	0.01
Sabinene	3.80*	969	0.06	2.37	1084	0.05
$\beta$ -Pinene	3.80*	969	[0.06]	2.18	1066	0.01
Octan-3-one	4.06	986	tr	4.10*	1221	0.03
Myrcene	4.14	991	0.36	2.98	1134	0.35
Octanal	4.30	1002	0.01	4.55	1254	0.01
para-Cymene	4.60	1021	0.01	4.22	1230	0.04
Limonene	4.74*	1030	38.41	3.38	1165	38.04
1,8-Cineole	4.74*	1030	[38.41]	3.42	1168	0.03
(Z)- $\beta$ -Ocimene	4.89	1039	0.01	3.90	1206	0.01
(E)- $\beta$ -Ocimene	5.04	1049	0.02	4.10*	1221	[0.03]
$\gamma$ -Terpinene	5.16	1056	0.04	3.93	1208	0.04
Fenchone	5.57	1082	tr	5.83	1343	tr
6,7-Epoxyterpinene	5.78	1095	tr			
Linalool	5.86	1100	0.03	8.19	1517	0.04
Unknown [m/z 43, 59 (37), 79 (33), 91 (32), 119 (31)...]	5.91	1103	0.01	9.17	1592	0.01
<i>trans</i> -para-Mentha-2,8-dien-1-ol	6.12*	1117	0.13	9.08	1585	0.13
Unknown [m/z 41, 67 (75), 69 (59), 79 (55), 81 (44), 71 (41)... 150 (5)]	6.12*	1117	[0.13]	6.38	1382	0.01
<i>cis</i> -Limonene oxide	6.32	1130	0.15	6.56	1395	0.15
<i>cis</i> -para-Mentha-2,8-dien-1-ol	6.36	1132	0.09	9.60*	1627	0.10
<i>trans</i> -Limonene oxide	6.39	1135	0.13	6.73	1408	0.13
Unknown [m/z 69, 84 (62), 41 (30), 123 (26), 97 (24), 109 (23)...]	7.00	1174	0.03	9.79	1642	0.04
<i>trans</i> -Isocarveol	7.18	1186	0.02	11.08	1749	0.05
$\alpha$ -Terpineol	7.22	1189	0.10	9.96*	1656	0.11
Unknown [m/z 121, 79 (98), 93 (87), 94 (73), 91 (63), 105 (45)...]	7.28	1193	0.06	7.92	1496	0.04
Unknown [m/z 121, 79 (61), 93	7.34	1196	0.06			

(55), 94 (40), 91 (39), 84 (37)...						
<i>trans</i> -Dihydrocarvone	7.39*	1199	0.12	8.83	1566	0.09
Unknown [m/z 121, 67 (75), 93 (64), 95 (52), 81 (47), 41 (42)...	7.39*	1199	[0.12]			
<i>iso</i> -Dihydrocarveol ?	7.68	1219	0.02	10.93	1736	0.01
<i>trans</i> -Carveol	7.76	1225	0.31	11.53	1786	0.32
<i>cis</i> -Carveol	7.91	1235	0.08	11.86	1816	0.16
Carvone	8.13*	1250	48.65	10.22*	1677	48.49
Neral	8.13*	1250	[48.65]	9.60*	1627	[0.10]
Isopiperitenone	8.37	1267	0.01	11.34*	1770	0.03
Perillaldehyde	8.44	1272	0.20	10.68	1715	0.19
<i>trans</i> -Carvone oxide	8.52	1277	0.02	11.34*	1770	[0.03]
( <i>E</i> )-Anethole	8.64	1285	0.05	11.28	1765	0.05
Perillyl alcohol	8.74	1292	0.01	13.40	1954	0.01
Thymol	8.85	1300	0.03	15.26	2132	0.03
Carvacrol	8.97	1308	0.01	15.54	2160	0.02
Limonene <i>trans</i> -glycol	9.43*	1334	0.06	16.09	2216	0.05
<i>trans</i> -Carvyl acetate	9.43*	1334	[0.06]	10.35	1687	0.01
<i>cis</i> -Carvyl acetate	9.80	1361	0.01	10.77	1722	tr
Unknown [m/z 98, 69 (40), 70 (40), 41 (22), 43 (14), 109 (13)... 166? (t)]	9.85	1365	0.05	16.23*	2230	0.05
$\beta$ -Bourbonene	10.05	1379	0.01	7.62	1473	0.01
$\beta$ -Elemene	10.19	1388	0.02	8.61	1549	0.02
Unknown [m/z 108, 109 (99), 82 (58), 91 (48), 79 (45), 43 (44)...	10.34	1399	0.02			
Unknown [m/z 109, 108 (82), 82 (44), 91 (42), 79 (36), 43 (35)...	10.38	1402	0.02			
$\beta$ -Caryophyllene	10.52	1412	0.07	8.55	1545	0.08
$\alpha$ -Humulene	10.97	1447	0.01	9.44	1614	0.01
Germacrene D	11.35	1475	0.03	9.96*	1656	[0.11]
$\beta$ -Selinene	11.42	1480	0.01	10.22*	1677	[48.49]
$\alpha$ -Selinene	11.56*	1491	0.01	10.22*	1677	[48.49]
Bicyclogermacrene	11.56*	1491	[0.01]	10.22*	1677	[48.49]
7-epi- $\alpha$ -Selinene	11.83	1511	0.01	10.59	1707	0.01
Salviadienol?	12.25	1545	0.01	14.49	2056	0.02
Spathulenol	12.58	1571	0.02	14.53	2061	0.02
Caryophyllene oxide	12.63*	1575	0.05	12.91	1908	0.05

Caryophyllene oxide isomer	12.63*	1575	[0.05]	12.83	1901	0.01
Salvial-4(14)-en-1-one	12.77	1586	0.01	13.18	1934	0.01
Caryophylladienol II	13.31	1630	0.01	16.23*	2230	[0.05]
Unknown [m/z 123, 43 (86), 81 (75), 95 (73), 82 (68), 161 (64), 105 (63)... 220 (6)]	13.39	1636	tr			
Unknown [m/z 43, 81 (84), 41 (64), 67 (62), 95 (58), 79 (58)... 204 (48), 220 (2)]	13.56	1650	0.02	15.60	2166	0.01
Unknown [m/z 205, 93 (93), 43 (58), 79 (510, 91 (48), 119 (45)... 220 (3)]	13.68	1661	0.01	16.33	2241	0.01
(3Z)-Caryophylla-3,8(13)-dien-5 $\beta$ -ol	13.75	1666	0.01	16.95	2305	0.04
Germacra-4(15),5,10(14)-trien-1 $\alpha$ -ol	13.91	1680	0.01	16.19	2226	0.01
Unknown [m/z 133, 93 (97), 131 (85), 145 (83), 107 (69)...220]	14.12	1697	0.01	17.10	2321	0.09
Unknown [m/z 159, 93 (87), 105 (84), 91 (81), 107 (71), 131 (69), 79 (65), 119 (63), 145 (62), 41 (61), 220 (61)]	14.27	1710	0.01			
Unknown [m/z 43, 71 (88), 93 (86), 41 (74), 55 (73), 81 (71), 95 (59), 91 (53), 67 (52)... 220 (13)... 236? (t)]	14.32	1714	0.01	17.48	2363	0.02
Unknown [m/z 123. 191 (88), 81 (86), 41 (86), 151 (80), 91 (76)...]	15.60	1827	0.03			
Unknown [m/z 43, 107 (97), 81 (83), 121 (77), 123 (74), 93 (73)... 220 (26)...]	15.80	1845	0.02	20.57	2720	0.02
Phytone	15.84	1848	0.03	14.83	2089	0.06

Unknown [m/z 123, 81 (96), 41 (74), 43 (64), 91 (62), 95 (57)...]	16.25	1886	0.01			
Methyl palmitate	16.68	1926	0.01	15.73	2179	0.01
Palmitic acid	17.15	1971	0.62	21.71	2863	0.68
(Z)-Falcarinol	17.81	2035	0.01	22.52	2970	0.01
Methyl linoleate	18.42	2095	0.03	18.29	2452	0.01
Methyl petroselinate?	18.50	2104	0.04			
Phytol	18.62	2116	0.08	19.35	2573	0.14
Linoleic acid	18.85	2140	1.34	23.83	3148	1.53
Oleic acid	18.94†	2149	2.48	23.50†	3102	[2.63]
cis-Vaccenic acid?	18.96†	2152	[2.48]	23.47†	3098	2.63
Stearic acid	19.18	2174	1.06	23.29	3073	1.15
Panaxydol?	19.39	2195	0.05			
Panaxydol isomer?	22.71	2570	0.05			
Unknown [m/z 137, 136 (87), 81 (80), 93 (64), 107 (58), 121 (49)...]	24.22	2758	0.18			
Squalene	24.74	2825	0.18	22.94	3025	0.34
Nonacosane	25.32	2903	0.19	21.89	2886	0.23
Unknown [m/z 81, 137 (67), 95 (41), 55 (16), 136 (15)...]	25.50†	2927	0.38			
Unknown [m/z 81, 137 (58), 95 (42), 67 (22), 55 (18), 69 (14)...]	25.52†	2929	[0.38]			
<b>Total identified</b>		<b>95.66%</b>			<b>95.99%</b>	
<b>Total reported</b>		<b>96.59%</b>			<b>96.24%</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