Date : November 25, 2022

Certificate of Analysis – GC Profiling

Sample identification

Internal code : 22K11-NSO02
Customer identification : Organic Essential Oil: Clove Bud Lot # OCLB322004 Botanical species: Eugenia caryophyllata
Type : Essential oil
Source : *Eugenia caryophyllus*
Customer : Natural Sourcing LLC

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 : Amélie Simard, Analyste
Analysis date : November 23, 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Notes: This report may not be published, including online, without the written consent from Laboratoire PhytoChemia.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

Laboratoire PhytoChemia

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PHYSICOCHEMICAL DATA

Physical aspect: Light yellow liquid
Refractive index: 1.5350 ± 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
2-Methylbutyral	tr	Aliphatic aldehyde
Furfural	0.10	Furan
α-Pinene	0.01	Monoterpene
Benzaldehyde	0.01	Simple phenolic
5-Methylfurfural	0.03	Furan
β-Pinene	0.01	Monoterpene
6-Methyl-5-hepten-2-one	0.01	Aliphatic ketone
para-Cymene	0.01	Monoterpene
Limonene	0.02	Monoterpene
2-Heptyl acetate	0.01	Aliphatic ester
Isoterpinolene	0.01	Monoterpene
Linalool	0.02	Monoterpenic alcohol
(*E*)-4,8-Dimethylnona-1,3,7-triene	0.02	Terpene derivative
α-Terpineol	0.01	Monoterpenic alcohol
Methyl salicylate	0.05	Phenolic ester
Chavicol	0.43	Phenylpropanoid
α-Cubebene	0.03	Sesquiterpene
Eugenol	73.08	Phenylpropanoid
Dihydroeugenol	0.17	Phenylpropanoid
α-Copaene	0.40	Sesquiterpene
β-Bourbonene	0.02	Sesquiterpene
β-Elemene	0.02	Sesquiterpene
Vanillin	0.14	Simple phenolic
Isocaryophyllene	0.03	Sesquiterpene
Methyleugenol	0.04	Phenylpropanoid
β-Caryophyllene	6.20	Sesquiterpene
Caryophylla-4(12),8(13)-diene	0.06	Sesquiterpene
9-epi-Isocaryophyllene	0.04	Sesquiterpene
α-Humulene	0.87	Sesquiterpene
allo-Aromadendrene	0.04	Sesquiterpene
trans-Cadina-1(6),4-diene	0.05	Sesquiterpene
γ-Muurolene	0.08	Sesquiterpene
Germacrene D	0.02	Sesquiterpene
β-Selinene	0.03	Sesquiterpene
α-Selinene	0.05	Sesquiterpene
α-Muurolene	0.06	Sesquiterpene
γ-Cadinene	0.09	Sesquiterpene
trans-Calamenene	0.35	Sesquiterpene
δ-Cadinene	0.50	Sesquiterpene
Eugenyl acetate	9.77	Phenylpropanoid ester
α-Calacorene	0.05	Sesquiterpene
Unknown	0.08	Unknown
Unknown	0.05	Phenylpropanoid
Caryophyllenyl alcohol	0.18	Sesquiterpenic alcohol

Caryophyllene oxide	2.13	Sesquiterpenic ether
Caryophyllene oxide isomer	0.13	Sesquiterpenic ether
Unknown	0.04	Oxygenated sesquiterpene
Unknown	0.04	Unknown
Humulene epoxide I	0.04	Sesquiterpenic ether
Widdrol	0.14	Sesquiterpenic alcohol
Humulene epoxide II	0.29	Sesquiterpenic ether
(*E*)-Isoeugenyl acetate	0.09	Phenylpropanoid ester
1-epi-Cubenol	0.16	Sesquiterpenic alcohol
Caryophylladienol I	0.08	Sesquiterpenic alcohol
Caryophylladienol II	0.10	Sesquiterpenic alcohol
τ-Cadinol	0.08	Sesquiterpenic alcohol
α-Muurolol	0.05	Sesquiterpenic alcohol
Unknown	0.01	Sesquiterpenic alcohol
α-Cadinol	0.03	Sesquiterpenic alcohol
14-Hydroxy-(*Z*)-caryophyllene	0.16	Sesquiterpenic alcohol
14-Hydroxy-9-epi-(*E*)-caryophyllene	0.03	Sesquiterpenic alcohol
14-Hydroxy-(*E*)-caryophyllene	0.26	Sesquiterpenic alcohol
Germacra-4(15),5,10(14)-trien-1α-ol	0.01	Sesquiterpenic alcohol
Trimethoxypropylbenzene analog	0.16	Phenylpropanoid
Unknown	0.02	Unknown
(*E*)-Coniferyl alcohol	0.12	Phenylpropanoid
Caryolane-1,9β-diol	0.21	Sesquiterpenic alcohol
(*E*)-2-Methoxy-4-(3-oxo-1-propenyl)phenyl acetate	0.04	Phenylpropanoid ester
(*E*)-4-(3-Hydroxy-1-propenyl)-2-methoxyphenyl acetate	0.02	Phenylpropanoid ester
Unknown	0.22	Lignan
Unknown	0.07	Lignan
Unknown	0.01	Unknown
Consolidated total	**97.99%**	

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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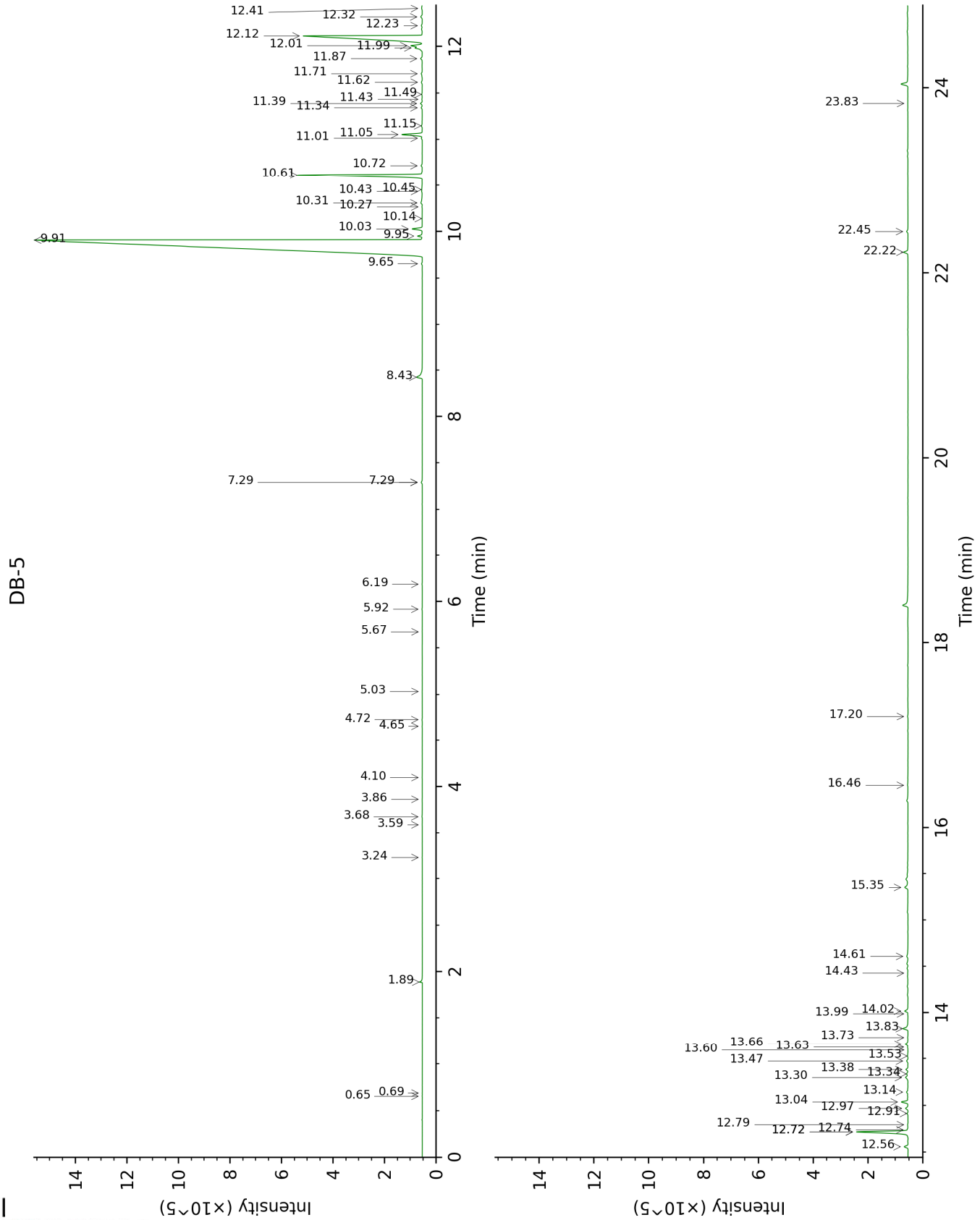
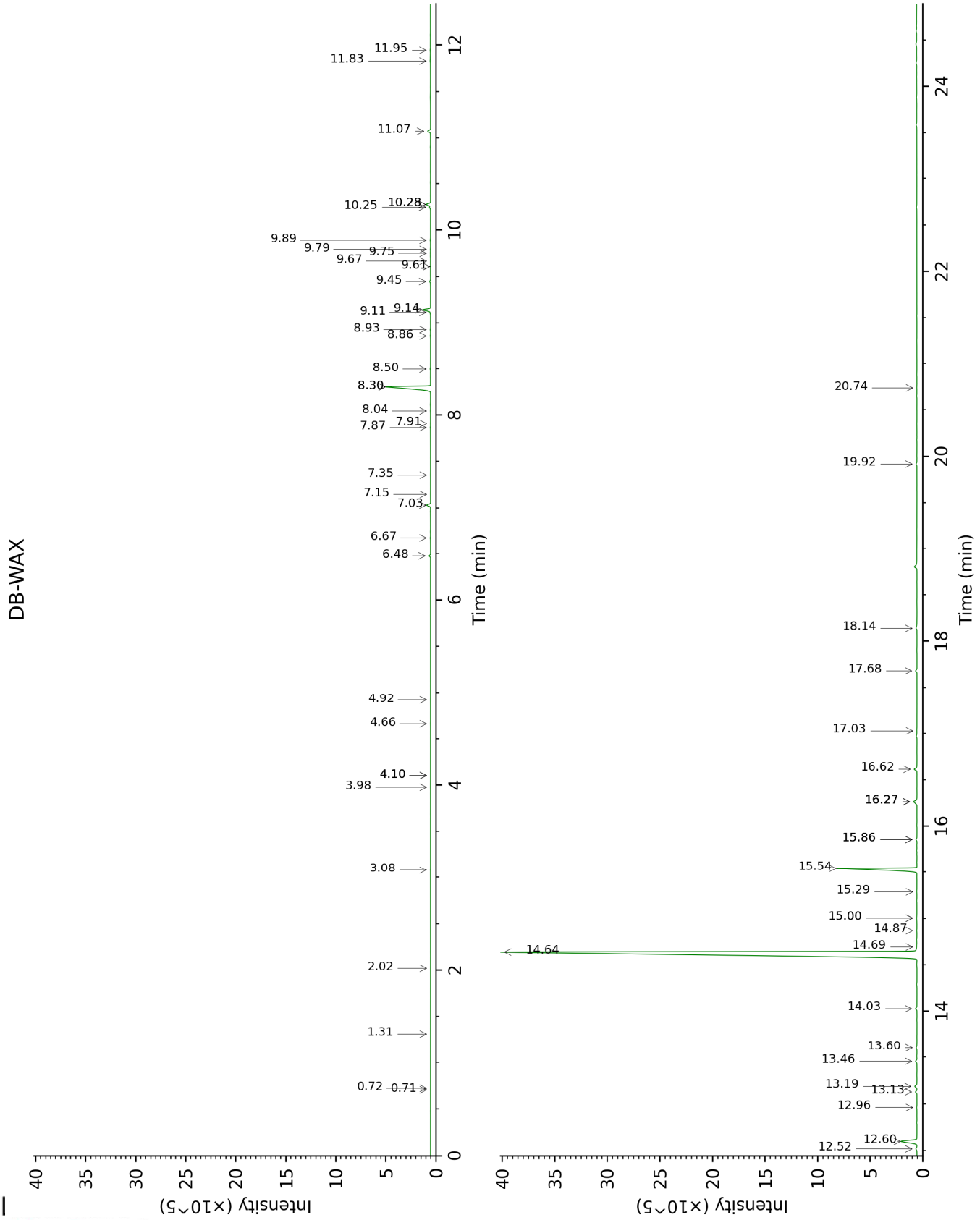

DB-5
12.41
12.32
12.23
12.12
12.01
11.99
11.87
11.71
11.62
11.39
11.43
11.49
11.34
11.15
11.01
11.05
10.72
10.61
10.43
10.45
10.31
10.27
10.14
10.03
9.95
9.91
9.65
8.43
7.29
7.29
6.19
5.92
5.67
5.03
4.72
4.65
4.10
3.86
3.68
3.59
3.24
1.89
0.65
0.69
Time (min)
Intensity (×10^5)
23.83
22.45
22.22
17.20
16.46
15.35
14.61
14.43
13.99
14.02
13.83
13.73
13.60
13.66
13.63
13.53
13.47
13.30
13.38
13.34
13.14
13.04
12.97
12.91
12.79
12.72
12.74
12.56
Time (min)
Intensity (×10^5)


DB-WAX
Intensity (×10^5)
Time (min)
11.95
11.83
11.07
10.25
10.28
9.89
9.79
9.75
9.67
9.61
9.45
9.11
9.14
8.93
8.86
8.50
8.30
8.04
7.87
7.91
7.35
7.15
7.03
6.67
6.48
4.92
4.66
4.10
3.98
3.08
2.02
1.31
0.72
0.71
20.74
19.92
18.14
17.68
17.03
16.62
16.27
15.86
15.54
15.29
15.00
14.87
14.69
14.64
14.03
13.60
13.46
13.19
13.13
12.96
12.60
12.52

FULL ANALYSIS DATA

Identification	Column DB-5			Column DB-WAX		
	R.T	R.I	%	R.T	R.I	%
Isovaleral	0.65	641	tr	0.72	886	tr
2-Methylbutyral	0.69	652	tr	0.71	879	tr
Furfural	1.89	827	0.10	6.48	1406	0.13
α-Pinene	3.24	930	0.01	1.31	991	tr
Benzaldehyde	3.59	953	0.01	7.15	1456	0.01
5-Methylfurfural	3.68	959	0.03	7.87	1511	0.03
β-Pinene	3.86	971	0.01	2.02	1065	tr
6-Methyl-5-hepten-2-one	4.10	987	0.01	4.92	1300	0.01
para-Cymene	4.65	1022	0.01	3.98	1228	0.01
Limonene	4.72	1026	0.02	3.08	1157	0.02
2-Heptyl acetate	5.03	1046	0.01	4.10*	1238	0.01
Isoterpinolene	5.68	1086	0.01	4.10*	1238	[0.01]
Linalool	5.92	1101	0.02	7.91	1514	0.02
(*E*)-4,8-Dimethylnona-1,3,7-triene	6.19	1118	0.02	4.66	1280	0.01
α-Terpineol	7.29*	1189	0.06	9.61	1649	0.01
Methyl salicylate	7.29*	1189	[0.06]	10.28*	1704	0.49
Chavicol	8.42	1263	0.43	16.26*	2266	0.51
α-Cubebene	9.65	1346	0.03	6.67	1420	0.04
Eugenol	9.91†	1364	73.16	14.64	2100	73.08
Dihydroeugenol	9.95†	1367	[73.16]	14.03	2041	0.17
α-Copaene	10.03†	1372	[73.16]	7.03	1448	0.40
β-Bourbonene	10.14	1380	0.02	7.35	1472	0.01
β-Elemene	10.27	1389	0.02	8.30*	1545	6.20
Vanillin	10.31	1392	0.14	18.14	2470	0.16
Isocaryophyllene	10.43	1401	0.03	8.04	1524	0.03
Methyleugenol	10.45	1402	0.04	13.13	1955	0.17
β-Caryophyllene	10.61	1414	6.20	8.30*	1545	[6.20]
Caryophylla-4(12),8(13)-diene	10.72	1422	0.06	8.50	1560	0.05
9-epi-Isocaryophyllene	11.01	1444	0.04	8.93	1594	0.04
α-Humulene	11.05	1447	0.87	9.14	1611	0.85
allo-Aromadendrene	11.15	1454	0.04	8.86	1588	0.04
trans-Cadina-1(6),4-diene	11.34	1468	0.05	9.11	1608	0.04
γ-Muurolene	11.39	1472	0.08	9.45	1636	0.09
Germacrene D	11.43	1475	0.02	9.67	1654	0.01
β-Selinene	11.49	1479	0.03	9.75	1660	0.03
α-Selinene	11.62	1489	0.05	9.79	1664	0.03
α-Muurolene	11.71	1495	0.06	9.89	1672	0.04
γ-Cadinene	11.87	1508	0.09	10.25	1701	0.11
trans-Calamenene	11.99	1517	0.35	11.07	1771	0.30
δ-Cadinene	12.01	1519	0.50	10.28*	1704	[0.49]
Eugenyl acetate	12.12	1527	9.77	15.54	2190	9.65
α-Calacorene	12.23	1536	0.05	11.94	1848	0.06
Unknown [m/z 164, 135 (98), 93 (86), 107 (83), 79 (69)...]	12.32	1543	0.08	11.83	1838	0.07

Unknown [m/z 180, 93 (70), 55 (62), 77 (55), 164 (55), 103 (50)]	12.41	1550	0.05	20.74	2778	0.03
Caryophyllenyl alcohol	12.56	1562	0.18	13.46	1986	0.17
Caryophyllene oxide	12.72*	1574	2.27	12.60	1906	2.13
Caryophyllene oxide isomer	12.72*	1574	[2.27]	12.52	1899	0.13
Unknown [m/z 161, 187 (32), 105 (30), 205 (24)... 222 (3)]	12.74	1576	0.04	14.87	2123	0.03
Unknown [m/z 151, 178 (54), 123 (20), 55 (13), 161 (11), 77 (10)...]	12.79	1580	0.04			
Humulene epoxide I	12.91	1589	0.04	12.96	1940	0.06
Widdrol	12.97	1594	0.14			
Humulene epoxide II	13.04	1599	0.29	13.19	1961	0.29
(*E*)-Isoeugenyl acetate	13.14	1608	0.09	17.03	2347	0.03
1-epi-Cubenol	13.30	1620	0.16	13.60	2000	0.11
Caryophylladienol I	13.34	1624	0.08			
Caryophylladienol II	13.38	1627	0.10	15.86*	2223	0.11
τ-Cadinol	13.48	1635	0.08	14.69	2105	0.06
α-Muurolol	13.53	1639	0.05	15.00*	2136	0.07
Unknown cadinol analog II [m/z 95, 121 (73), 43 (57), 79 (43), 161 (43), 109 (40)... 204 (35), 222 (2)]	13.60	1645	0.01	15.00*	2136	[0.07]
α-Cadinol	13.63	1647	0.03	15.29	2165	0.04
14-Hydroxy-(*Z*)-caryophyllene	13.66	1650	0.16	16.26*	2266	[0.51]
14-Hydroxy-9-epi-(*E*)-caryophyllene	13.73	1656	0.03	16.26*	2266	[0.51]
14-Hydroxy-(*E*)-caryophyllene	13.83	1664	0.26	16.62	2302	0.33
Germacra-4(15),5,10(14)-trien-1α-ol	13.99	1677	0.01	15.86*	2223	[0.11]
Trimethoxypropylbenzene analog	14.02	1680	0.16	17.68	2419	0.15
Unknown [m/z 180, 125 (44), 55 (32), 93 (25), 43 (24), 149 (23)...]	14.43	1714	0.02			
(*E*)-Coniferyl alcohol	14.61	1729	0.12			
Caryolane-1,9β-diol	15.35	1793	0.21	19.92	2678	0.10
(*E*)-2-Methoxy-4-(3-oxo-1-propenyl)phenyl acetate	16.46	1893	0.04			
(*E*)-4-(3-Hydroxy-1-propenyl)-2-methoxyphenyl acetate	17.20	1962	0.02			
Unknown [m/z 326, 148 (67), 147 (41), 117 (30), 91 (22)...]	22.22	2490	0.22			

Unknown [m/z 326, 150 (54), 161 (42), 202 (41), 201 (28)]	22.44	2517	0.07	
Unknown [m/z 164, 165 (12), 55 (11), 81 (10), 69 (10), 95 (10)...]	23.83	2684	0.01	
Total identified		**96.96%**		**96.66%**
Total reported		**97.50%**		**96.79%**

*: 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