Date : January 22, 2021

Certificate of Analysis – GC Profiling

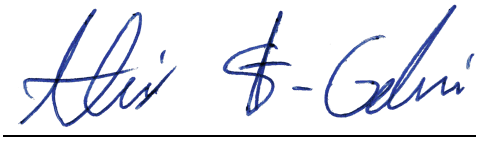
Sample identification

Internal code : 21A15-PTH04
Customer identification : Clove Bud ORGANIC - CH01112010R
Type : Essential oil
Source : *Syzygium aromaticum*
Customer : Plant Therapy

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 : Sarah-Eve Tremblay, M. Sc. A., Chimiste
Analysis date : January 21, 2021

Checked and approved by :



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

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Méthode certifiée ISO 17025:2017 Certified method

Laboratoire PhytoChemia

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PHYSICOCHEMICAL DATA

Physical aspect: Light yellow liquid
Refractive index: 1.5330 ± 0.0003 (20 °C; method PC-MAT-016)

ISO 3142:1997 - OIL OF CLOVE BUD

Compound	Min. %	Max. %	Observed %	Complies?
Eugenyl acetate	8	15	10	Yes
β-Caryophyllene	2	7	7	Yes
Eugenol	75	87	79	Yes
Refractive index	1.5280	1.5380	1.5330	Yes

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
Isobutyral	tr	Aliphatic aldehyde
Isovaleral	0.01	Aliphatic aldehyde
2-Methylbutyral	tr	Aliphatic aldehyde
Hexanal	tr	Aliphatic aldehyde
Furfural	0.03	Furan
2-Heptanone	0.02	Aliphatic ketone
2-Heptanol	tr	Aliphatic alcohol
5-Methylfurfural	tr	Furan
Myrcene	tr	Monoterpene
Ethyl hexanoate	tr	Aliphatic ester
Limonene	tr	Monoterpene
2-Heptyl acetate	0.05	Aliphatic ester
(*E*)-β-Ocimene	0.01	Monoterpene
cis-Sabinene hydrate	tr	Monoterpenic alcohol
2-Nonanone	0.04	Aliphatic ketone
Linalool	0.01	Monoterpenic alcohol
(*E*)-4,8-Dimethylnona-1,3,7-triene	0.02	Terpene derivative
Ethyl benzoate	0.01	Phenolic ester
Methyl salicylate	0.12	Phenolic ester
Chavicol	0.16	Phenylpropanoid
α-Cubebene	0.01	Sesquiterpene
Eugenol	79.43	Phenylpropanoid
α-Copaene	0.06	Sesquiterpene
Isocaryophyllene	0.01	Sesquiterpene
Methyleugenol	tr	Phenylpropanoid
β-Caryophyllene	6.53	Sesquiterpene
Caryophylla-4(12),8(13)-diene	0.02	Sesquiterpene
α-Humulene	0.75	Sesquiterpene
(*E*)-Isoeugenol	0.10	Phenylpropanoid
allo-Aromadendrene	0.01	Sesquiterpene
trans-Cadina-1(6),4-diene	0.01	Sesquiterpene
γ-Muurolene	0.02	Sesquiterpene
Germacrene D	0.02	Sesquiterpene
β-Selinene	0.01	Sesquiterpene
α-Selinene	0.02	Sesquiterpene
α-Muurolene	0.01	Sesquiterpene
(3*Z*,6*E*)-α-Farnesene	tr	Sesquiterpene
Cubebol	0.02	Sesquiterpenic alcohol
γ-Cadinene	0.01	Sesquiterpene
trans-Calamenene	0.01	Sesquiterpene
δ-Cadinene	0.06	Sesquiterpene
Eugenyl acetate	10.01	Phenylpropanoid ester
α-Calacorene	0.02	Sesquiterpene
Unknown	0.09	Unknown
Unknown	tr	Phenylpropanoid

Caryophyllenyl alcohol	0.04	Sesquiterpenic alcohol
(*E*)-Nerolidol	0.01	Sesquiterpenic alcohol
Caryophyllene oxide	0.29	Sesquiterpenic ether
Caryophyllene oxide isomer	0.03	Sesquiterpenic ether
Unknown	0.01	Oxygenated sesquiterpene
Humulene epoxide I	0.01	Sesquiterpenic ether
Widdrol	0.03	Sesquiterpenic alcohol
Humulene epoxide II	0.04	Sesquiterpenic ether
(*E*)-Isoeugenyl acetate	0.04	Phenylpropanoid ester
1-epi-Cubenol	0.01	Sesquiterpenic alcohol
Caryophylladienol I	0.08	Sesquiterpenic alcohol
Caryophylladienol II	0.11	Sesquiterpenic alcohol
τ-Cadinol	0.01	Sesquiterpenic alcohol
α-Muurolol	tr	Sesquiterpenic alcohol
α-Cadinol	0.01	Sesquiterpenic alcohol
14-Hydroxy-(*Z*)-caryophyllene	0.05	Sesquiterpenic alcohol
14-Hydroxy-9-epi-(*E*)-caryophyllene	0.01	Sesquiterpenic alcohol
(3*Z*)-Caryophylla-3,8(13)-dien-5β-ol	0.07	Sesquiterpenic alcohol
Trimethoxypropylbenzene analog	0.04	Phenylpropanoid
Unknown	tr	Unknown
(*E*)-Coniferyl alcohol	tr	Phenylpropanoid
(*E*)-Coniferaldehyde	0.01	Phenylpropanoid
Benzyl benzoate	0.05	Phenolic ester
Unknown	tr	Oxygenated sesquiterpene
Benzyl salicylate	0.01	Phenolic ester
(*E*)-4-(3-Hydroxy-1-propenyl)-2-methoxyphenyl acetate	0.06	Phenylpropanoid ester
Unknown	0.03	Lignan
Unknown	0.02	Lignan
Squalene	0.02	Triterpene
Consolidated total	**98.83%**	

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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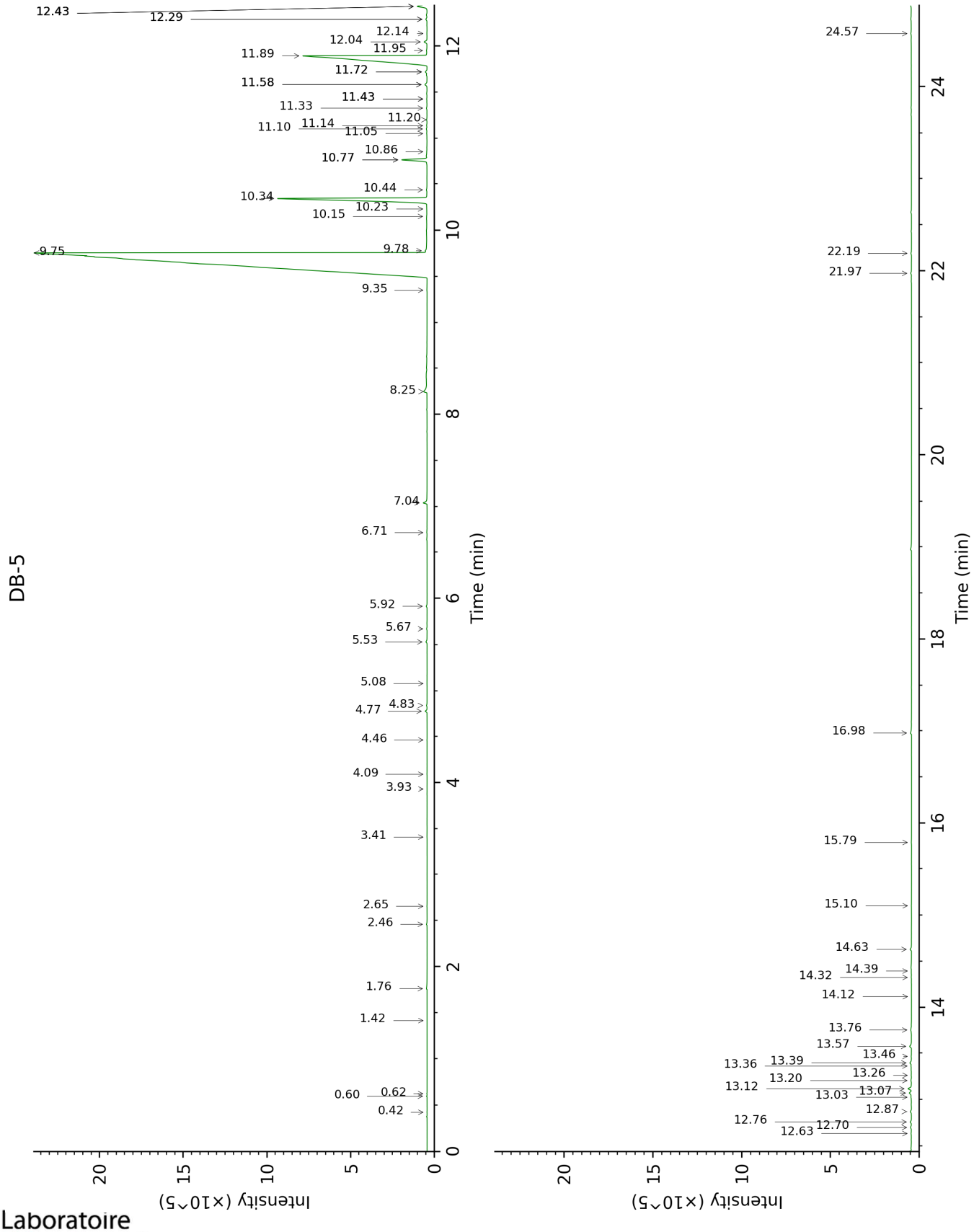
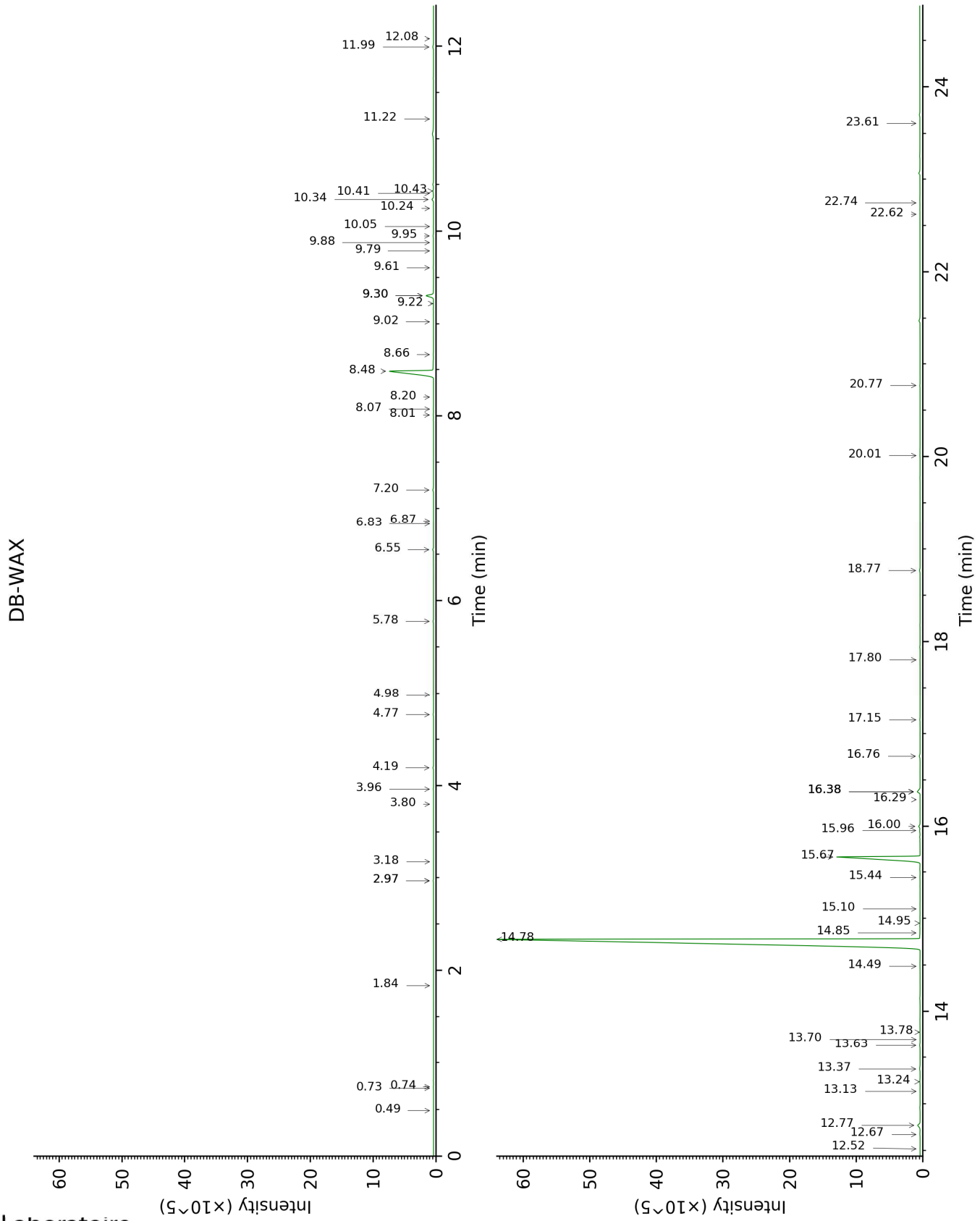

DB-5
Time (min)
Intensity (×10^5)
12.43
12.29
12.04
12.14
11.95
11.89
11.72
11.58
11.43
11.33
11.20
11.10
11.14
11.05
10.86
10.77
10.44
10.34
10.23
10.15
9.78
9.75
9.35
8.25
7.04
6.71
5.92
5.67
5.53
5.08
4.83
4.77
4.46
4.09
3.93
3.41
2.65
2.46
1.76
1.42
0.62
0.60
0.42
24.57
22.19
21.97
16.98
15.79
15.10
14.63
14.39
14.32
14.12
13.76
13.57
13.46
13.39
13.36
13.26
13.20
13.12
13.07
13.03
12.87
12.76
12.70
12.63


DB-WAX
Intensity (×10^5)
Time (min)
12.08
11.99
11.22
10.34
10.41
10.43
10.24
10.05
9.95
9.88
9.79
9.61
9.30
9.22
9.02
8.66
8.48
8.20
8.07
8.01
7.20
6.83
6.87
6.55
5.78
4.98
4.77
4.19
3.96
3.80
3.18
2.97
1.84
0.73
0.74
0.49
23.61
22.74
22.62
20.77
20.01
18.77
17.80
17.15
16.76
16.38
16.29
15.96
16.00
15.67
15.44
15.10
14.95
14.85
14.78
14.49
13.78
13.70
13.63
13.37
13.24
13.13
12.77
12.67
12.52

FULL ANALYSIS DATA

Identification	Column DB-5			Column DB-WAX		
	R.T	R.I	%	R.T	R.I	%
Isobutyral	0.42	541	tr	0.49	785	tr
Isovaleral	0.60	639	0.01	0.74	888	0.01
2-Methylbutyral	0.62	651	tr	0.73	882	tr
Hexanal	1.42	804	tr	1.84	1042	tr
Furfural	1.76	833	0.03	6.55	1406	0.06
2-Heptanone	2.46	891	0.02	2.97*	1143	0.02
2-Heptanol	2.65	906	tr	4.98	1297	0.01
5-Methylfurfural	3.41	956	tr	8.01	1515	0.02
Myrcene	3.93	991	tr	2.97*	1143	[0.02]
Ethyl hexanoate	4.09	1002	tr	3.80	1208	tr
Limonene	4.46	1025	tr	3.18	1160	tr
2-Heptyl acetate	4.77	1045	0.05	4.19	1238	0.05
(*E*)-β-Ocimene	4.84	1049	0.01	3.96	1220	0.02
cis-Sabinene hydrate	5.08	1064	tr	6.87	1430	tr
2-Nonanone	5.53	1093	0.04	5.78	1351	0.04
Linalool	5.67	1102	0.01	8.07	1520	0.01
(*E*)-4,8-Dimethylnona-1,3,7-triene	5.92	1118	0.02	4.77	1280	0.03
Ethyl benzoate	6.71	1168	0.01	9.30*	1616	0.76
Methyl salicylate	7.04	1189	0.12	10.34	1700	0.14
Chavicol	8.25	1269	0.16	16.38*	2269	0.32
α-Cubebene	9.35	1344	0.01	6.83	1427	tr
Eugenol	9.75†	1373	80.11	14.78	2104	79.43
α-Copaene	9.78†	1374	[80.11]	7.20	1454	0.06
Isocaryophyllene	10.15	1400	0.01	8.20	1530	0.01
Methyleugenol	10.23	1406	tr	13.24	1956	0.03
β-Caryophyllene	10.34	1415	6.53	8.48	1552	6.33
Caryophylla-4(12),8(13)-diene	10.44	1422	0.02	8.66	1566	0.01
α-Humulene	10.77*	1446	0.77	9.30*	1616	[0.76]
(*E*)-Isoeugenol	10.77*	1446	[0.77]	16.38*	2269	[0.32]
allo-Aromadendrene	10.86	1453	0.01	9.02	1594	0.01
trans-Cadina-1(6),4-diene	11.05	1467	0.01	9.22	1609	0.01
γ-Muurolene	11.10	1471	0.02	9.60	1641	0.02
Germacrene D	11.14	1474	0.02	9.79	1655	0.01
β-Selinene	11.20	1478	0.01	9.88	1663	0.01
α-Selinene	11.33	1488	0.02	9.95	1668	0.03
α-Muurolene	11.43*	1495	0.01	10.05	1677	0.01
(3*Z*,6*E*)-α-Farnesene	11.43*	1495	[0.01]	10.24	1692	tr
Cubebol	11.58*	1507	0.08	12.52	1890	0.02
γ-Cadinene	11.58*	1507	[0.08]	10.41	1706	0.01
trans-Calamenene	11.72*	1518	0.06	11.22	1775	0.01
δ-Cadinene	11.72*	1518	[0.06]	10.43	1708	0.06
Eugenyl acetate	11.89	1531	10.01	15.67	2195	9.91
α-Calacorene	11.95	1536	0.02	12.08	1851	0.01
Unknown [m/z 164, 135 (98), 93 (86), 107 (83), 79 (69)...]	12.04	1543	0.09	11.99	1843	0.08

Unknown [m/z 180, 93 (70), 55 (62), 77 (55), 164 (55), 103 (50)]	12.14	1550	tr	20.77	2783	0.02
Caryophyllenyl alcohol	12.29*	1562	0.04	13.63	1993	0.04
(*E*)-Nerolidol	12.29*	1562	[0.04]	13.70	1999	0.01
Caryophyllene oxide	12.43*	1573	0.33	12.77	1913	0.29
Caryophyllene oxide isomer	12.43*	1573	[0.33]	12.67	1904	0.03
Unknown [m/z 161, 187 (32), 105 (30), 205 (24)... 222 (3)]	12.43*	1573	[0.33]	14.95	2122	0.01
Humulene epoxide I	12.64	1589	0.01	13.13	1947	0.01
Widdrol	12.70	1594	0.03	14.49	2076	0.03
Humulene epoxide II	12.76	1599	0.04	13.37	1969	0.05
(*E*)-Isoeugenyl acetate	12.87	1608	0.04	17.15	2353	0.02
1-epi-Cubenol	13.02	1621	0.01	13.78	2007	0.01
Caryophylladienol I	13.07	1624	0.08	15.96	2225	0.03
Caryophylladienol II	13.12	1628	0.11	16.00	2230	0.12
τ-Cadinol	13.20	1635	0.01	14.85	2111	0.02
α-Muurolol	13.26	1640	tr	15.10	2138	0.01
α-Cadinol	13.36	1648	0.01	15.44	2172	0.02
14-Hydroxy-(*Z*)-caryophyllene	13.39	1651	0.05	16.38*	2269	[0.32]
14-Hydroxy-9-epi-(*E*)-caryophyllene	13.46	1657	0.01	16.29	2260	tr
(3*Z*)-Caryophylla-3,8(13)-dien-5β-ol	13.57	1666	0.07	16.76	2310	0.08
Trimethoxypropylbenzene analog	13.76	1681	0.04	17.80	2426	0.01
Unknown [m/z 180, 125 (44), 55 (32), 93 (25), 43 (24), 149 (23)...]	14.12	1711	tr			
(*E*)-Coniferyl alcohol	14.32	1729	tr	22.74	3047	tr
(*E*)-Coniferaldehyde	14.39	1735	0.01	23.61	3170	0.01
Benzyl benzoate	14.63	1755	0.05	18.77	2537	0.05
Unknown [m/z 109, 123 (96), 127 (95), 55 (87), 81 (85), 41 (69)...220 (5)]	15.10	1796	tr			
Benzyl salicylate	15.79	1858	0.01	20.01	2687	0.01
(*E*)-4-(3-Hydroxy-1-propenyl)-2-methoxyphenyl acetate	16.98	1968	0.06			
Unknown [m/z 326, 148 (67), 147 (41), 117 (30), 91 (22)...]	21.97	2500	0.03			
Unknown [m/z 326, 150 (54), 161 (42), 202 (41), 201 (28)]	22.19	2526	0.02			
Squalene	24.58	2826	0.02	22.62	3030	tr
Total identified		**99.25%**			**98.33%**	
Total reported		**99.40%**			**98.44%**	

*: 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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