Date : October 18, 2019

Certificate of Analysis – GC Profiling

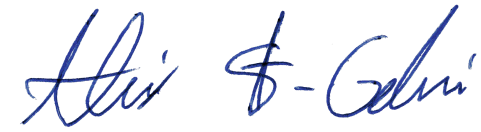
Sample identification

Internal code : 19J17-PTH02-1-SCC
Customer identification : Clove Bud Org - India - CH010796R
Type : Essential oil
Source : *Syzygium aromaticum*
Customer : Plant Therapy

Analysis

Method: PC-PA-014 - 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 : October 18, 2019

Checked and approved by :



Alexis St-Gelais, M. Sc., 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Notes: This report may not be published, including online, without the written consent from Laboratoire PhytoChemia.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.

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PHYSICOCHEMICAL DATA

Physical aspect: Light yellow liquid
Refractive index: 1.5356 ± 0.0003 (20 °C)

ISO 3142:1997 - OIL OF CLOVE BUD

Compound	Min. %	Max. %	Observed %	Complies?
Eugenyl acetate	8	15	9	Yes
β-Caryophyllene	2	7	6	Yes
Eugenol	75	87	81	Yes
Refractive index	1.5280	1.5380	1.5356	Yes

CONCLUSION

No adulterant, contaminant or diluent has been detected using this method. The oil complies with the ISO standard for clove bud oil.

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Analysis summary – Consolidated contents

New readers of similar reports are encouraged to read table footnotes at least once.

Identification	%	Classe
Furfural	0.01	Aliphatic alcohol
α-Pinene	tr	Monoterpene
6-Methyl-5-hepten-2-one	tr	Aliphatic ketone
Linalool	0.01	Monoterpenic alcohol
(*E*)-4,8-Dimethylnona-1,3,7-triene	0.01	Terpene derivative
Ethyl benzoate	tr	Phenolic ester
Methyl salicylate	0.05	Phenolic ester
Chavicol	0.10	Phenylpropanoid
α-Cubebene	0.03	Sesquiterpene
Eugenol	81.18	Phenylpropanoid
α-Copaene	0.10	Sesquiterpene
Dihydroeugenol	0.02	Phenylpropanoid
Vanillin	tr	Simple phenolic
Isocaryophyllene	0.01	Sesquiterpene
Methyleugenol	0.11	Phenylpropanoid
β-Caryophyllene	6.13	Sesquiterpene
Caryophylla-4(12),8(13)-diene	0.02	Sesquiterpene
9-epi-Isocaryophyllene	0.01	Sesquiterpene
α-Humulene	1.02	Sesquiterpene
(*E*)-Isoeugenol	0.30	Phenylpropanoid
allo-Aromadendrene	0.01	Sesquiterpene
trans-Cadina-1(6),4-diene	0.03	Sesquiterpene
γ-Muurolene	0.02	Sesquiterpene
Germacrene D	0.01	Sesquiterpene
β-Selinene	0.02	Sesquiterpene
δ-Selinene	tr	Sesquiterpene
α-Selinene	0.02	Sesquiterpene
Bicyclogermacrene	0.01	Sesquiterpene
α-Muurolene	0.02	Sesquiterpene
γ-Cadinene	0.05	Sesquiterpene
trans-Calamenene	0.06	Sesquiterpene
δ-Cadinene	0.12	Sesquiterpene
β-Sesquiphellandrene	0.02	Sesquiterpene
Eugenyl acetate	8.81	Phenylpropanoid ester
α-Calacorene	0.29	Sesquiterpene
Unknown	0.08	Unknown
Unknown	0.03	Phenylpropanoid
Caryophyllenyl alcohol	0.04	Sesquiterpenic alcohol
Unknown	tr	Oxygenated sesquiterpene
Caryophyllene oxide isomer	0.02	Sesquiterpenic ether
Caryophyllene oxide	0.33	Sesquiterpenic ether
Unknown	0.01	Unknown
Widdrol	0.01	Sesquiterpenic alcohol
Humulene epoxide II	0.05	Sesquiterpenic ether
(*E*)-Isoeugenyl acetate	0.04	Phenylpropanoid ester
1-epi-Cubenol	0.02	Sesquiterpenic alcohol
Caryophylladienol I	0.02	Sesquiterpenic alcohol

Caryophylladienol II	0.03	Sesquiterpenic alcohol
τ-Cadinol	0.01	Sesquiterpenic alcohol
α-Muurolol	0.01	Sesquiterpenic alcohol
14-Hydroxy-(*Z*)-caryophyllene	0.05	Sesquiterpenic alcohol
14-Hydroxy-9-epi-(*E*)-caryophyllene	0.01	Sesquiterpenic alcohol
Trimethoxypropylbenzene analog	0.03	Phenylpropanoid
(*E*)-Coniferyl alcohol	0.05	Phenylpropanoid
Unknown	0.01	Oxygenated sesquiterpene
(*E*)-2-Methoxy-4-(3-oxo-1-propenyl)phenyl acetate	tr	Phenylpropanoid ester
(*E*)-4-(3-Hydroxy-1-propenyl)-2-methoxyphenyl acetate	tr	Phenylpropanoid ester
Unknown	0.02	Lignan
Unknown	0.02	Lignan
Squalene	tr	Triterpene
Consolidated total	**99.50%**	

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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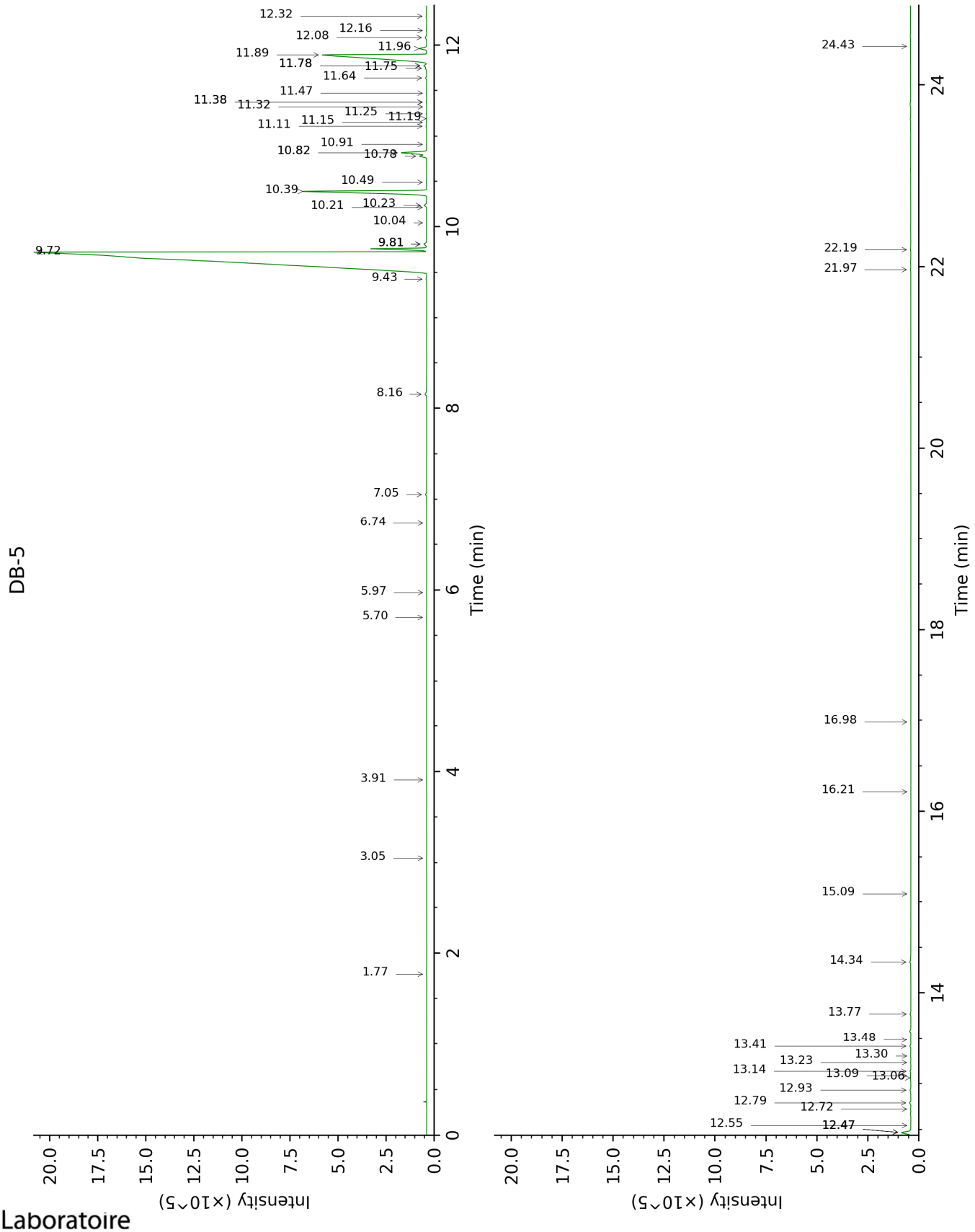
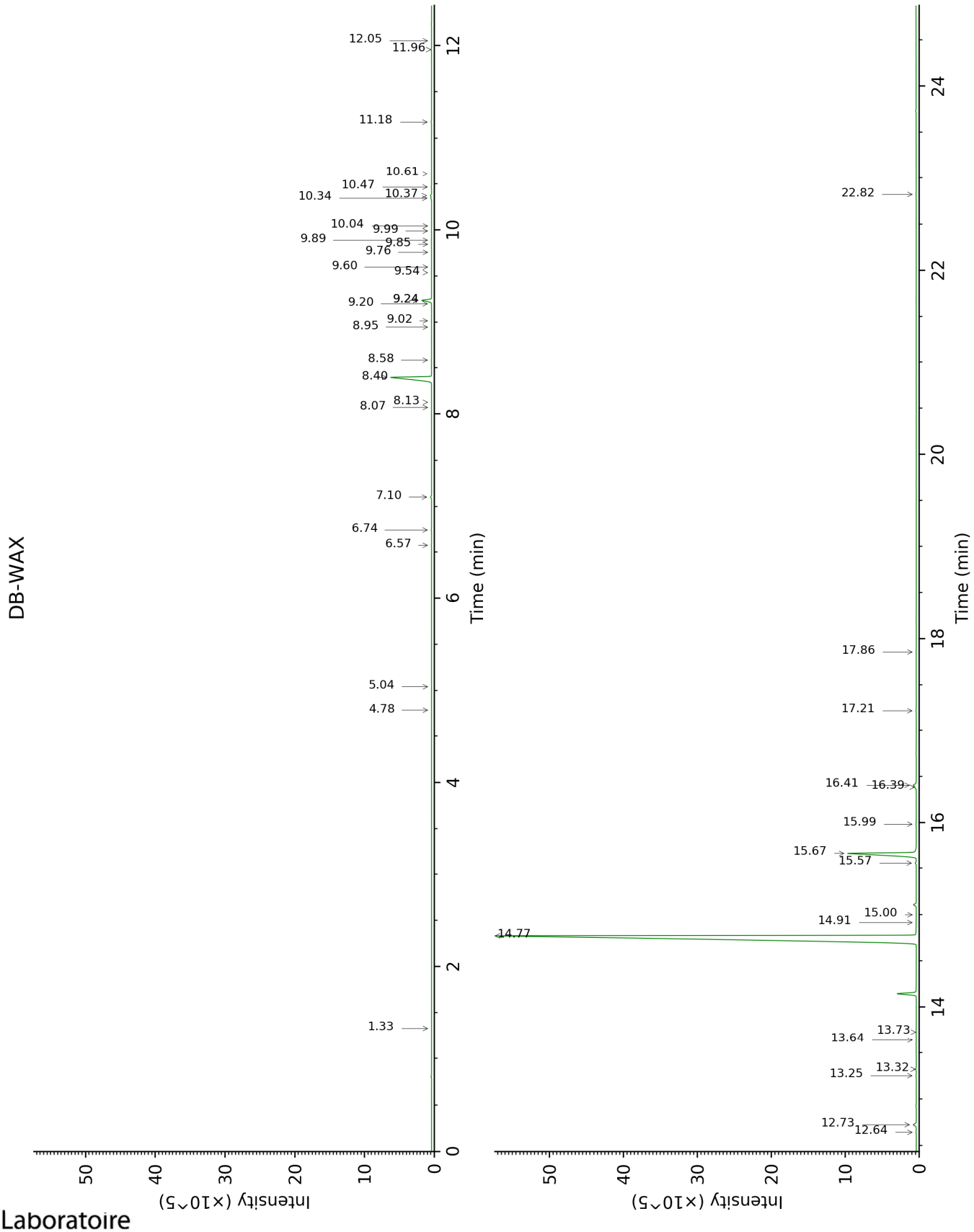

DB-5
12.32
12.16
12.08
11.96
11.89
11.78
11.75
11.64
11.47
11.38
11.32
11.25
11.19
11.15
11.11
10.91
10.82
10.78
10.49
10.39
10.23
10.21
10.04
9.81
9.72
9.43
8.16
7.05
6.74
5.97
5.70
3.91
3.05
1.77
Time (min)
Intensity (×10^5)
24.43
22.19
21.97
16.98
16.21
15.09
14.34
13.77
13.48
13.41
13.30
13.23
13.14
13.09
13.06
12.93
12.79
12.72
12.55
12.47
Time (min)
Intensity (×10^5)


DB-WAX
12.05
11.96
11.18
10.61
10.47
10.34
10.37
10.04
9.99
9.89
9.85
9.76
9.60
9.54
9.20
9.24
8.95
9.02
8.58
8.40
8.07
8.13
7.10
6.74
6.57
5.04
4.78
1.33
Time (min)
Intensity (×10^5)
22.82
17.86
17.21
16.41
16.39
15.99
15.67
15.57
14.91
15.00
14.77
13.64
13.73
13.25
13.32
12.73
12.64
Time (min)
Intensity (×10^5)

FULL ANALYSIS DATA

Identification	Column DB-5			Column DB-WAX		
	R.T	R.I	%	R.T	R.I	%
Furfural	1.77	830	0.01	6.57	1408	0.02
α-Pinene	3.05	928	tr	1.33	990	tr
6-Methyl-5-hepten-2-one	3.91	985	tr	5.04	1296	0.01
Linalool	5.70	1100	0.01	8.07	1519	0.01
(*E*)-4,8-Dimethylnona-1,3,7-triene	5.97	1117	0.01	4.78	1278	0.01
Ethyl benzoate	6.74	1167	tr	9.24*	1609	1.03
Methyl salicylate	7.06	1188	0.05	10.47	1709	0.03
Chavicol	8.16	1263	0.10	15.57	2177	0.09
α-Cubebene	9.43	1349	0.03	6.74	1420	0.03
Eugenol	9.72	1369	81.18	14.77	2097	81.55
α-Copaene	9.81*	1376	0.13	7.10	1446	0.10
Dihydroeugenol	9.81*	1376	[0.13]			
Vanillin	10.04	1392	tr			
Isocaryophyllene	10.21	1404	0.01	8.13	1523	0.01
Methyleugenol	10.24	1405	0.11	13.25	1953	0.03
β-Caryophyllene	10.39	1417	6.13	8.40	1544	6.02
Caryophylla-4(12),8(13)-diene	10.49	1424	0.02	8.58	1558	0.02
9-epi-Isocaryophyllene	10.78†	1446	1.33	9.02	1592	0.01
α-Humulene	10.82*†	1448	[1.33]	9.24*	1609	[1.03]
(*E*)-Isoeugenol	10.82*†	1448	[1.33]			
allo-Aromadendrene	10.91	1455	0.01	8.95	1586	0.01
trans-Cadina-1(6),4-diene	11.11	1470	0.03	9.20	1606	0.02
γ-Muurolene	11.15	1473	0.02	9.54	1634	0.02
Germacrene D	11.19	1476	0.01	9.76	1651	0.01
β-Selinene	11.25	1480	0.02	9.84	1658	0.01
δ-Selinene	11.32	1486	tr	9.60	1638	tr
α-Selinene	11.38*	1490	0.02	9.89	1662	0.02
Bicyclogermacrene	11.38*	1490	[0.02]	10.04	1674	0.01
α-Muurolene	11.47	1497	0.02	9.99	1670	0.01
γ-Cadinene	11.64	1509	0.05	10.34	1698	0.07
trans-Calamenene	11.75	1518	0.06	11.18	1769	0.05
δ-Cadinene	11.78*	1520	0.13	10.37	1701	0.12
β-Sesquiphellandrene	11.78*	1520	[0.13]	10.61	1721	0.02
Eugenyl acetate	11.89	1529	8.81	15.67	2187	8.74
α-Calacorene	11.96	1534	0.29	12.05	1845	0.01
Unknown [m/z 164, 135 (98), 93 (86), 107 (83), 79 (69)...]	12.08	1544	0.08	11.96	1837	0.04
Unknown [m/z 180, 93 (70), 55 (62), 77 (55), 164 (55), 103 (50)]	12.16	1550	0.03			
Caryophyllenyl alcohol	12.32	1562	0.04	13.64	1989	0.01
Unknown [m/z 161, 187 (32), 105 (30), 205 (24)... 222 (3)]	12.47*	1574	0.44	15.00	2120	tr
Caryophyllene oxide	12.47*	1574	[0.44]	12.64	1897	0.02

isomer						
Caryophyllene oxide	12.47*	1574	[0.44]	12.73	1904	0.33
Unknown [m/z 151, 178 (54), 123 (20), 55 (13), 161 (11), 77 (10)...]	12.55	1580	0.01			
Widdrol	12.72	1594	0.01			
Humulene epoxide II	12.79	1599	0.05	13.32	1959	0.04
(*E*)-Isoeugenyl acetate	12.93	1610	0.04	17.21	2349	0.05
1-epi-Cubenol	13.06	1621	0.02	13.73	1997	0.02
Caryophylladienol I	13.09	1623	0.02	15.99	2220	0.04
Caryophylladienol II	13.14	1627	0.03			
τ-Cadinol	13.23	1635	0.01	14.91	2112	0.01
α-Muurolol	13.30	1641	0.01			
14-Hydroxy-(*Z*)-caryophyllene	13.41	1650	0.05	16.41	2263	0.37
14-Hydroxy-9-epi-(*E*)-caryophyllene	13.48	1656	0.01	16.39	2261	0.11
Trimethoxypropylbenzene analog	13.77	1679	0.03	17.86	2420	0.03
(*E*)-Coniferyl alcohol	14.34	1728	0.05			
Unknown [m/z 109, 123 (96), 127 (95), 55 (87), 81 (85), 41 (69)...220 (5)]	15.09	1792	0.01			
(*E*)-2-Methoxy-4-(3-oxo-1-propenyl)phenyl acetate	16.22	1894	tr			
(*E*)-4-(3-Hydroxy-1-propenyl)-2-methoxyphenyl acetate	16.98	1967	tr			
Unknown [m/z 326, 148 (67), 147 (41), 117 (30), 91 (22)...]	21.97	2505	0.02			
Unknown [m/z 326, 150 (54), 161 (42), 202 (41), 201 (28)]	22.19	2532	0.02			
Squalene	24.42	2819	tr	22.82	3030	0.02
Total identified		**99.42%**			**99.13%**	
Total reported		**99.57%**			**99.17%**	

*: 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