

Date : May 04, 2023

CERTIFICATE OF ANALYSIS – GC PROFILING

SAMPLE IDENTIFICATION

**Internal code** : 23D20-NSO01


**Customer identification** : Organic Essential Oil : Tulsi (Holy Basil) Lot No: HBNA0423 Botanical Species :  
Ocimum sanctum

**Type** : Essential oil

**Source** : *Ocimum sanctum*

**Customer** : Natural Sourcing LLC

ANALYSIS

**Method**: PC-MAT-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** : Amélie Simard, Analyste

**Analysis date** : May 02, 2023

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*Notes: This report may not be published, including online, without the written consent from Laboratoire PhytoChemia.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.*

*PHYSICOCHEMICAL DATA*

**Physical aspect:** Yellow liquid

**Refractive index:**  $1.5217 \pm 0.0003$  (20 °C; method PC-MAT-016)

*CONCLUSION*

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

## ANALYSIS SUMMARY – CONSOLIDATED CONTENTS

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

Identification	%	Class
(3Z)-Hexenol	0.01	Aliphatic alcohol
$\alpha$ -Pinene	0.15	Monoterpene
Camphene	0.01	Monoterpene
Sabinene	0.04	Monoterpene
$\beta$ -Pinene	0.13	Monoterpene
Octen-3-ol	0.07	Aliphatic alcohol
Octan-3-one	tr	Aliphatic ketone
Myrcene	0.04	Monoterpene
Octan-3-ol	0.01	Aliphatic alcohol
$\alpha$ -Phellandrene	0.09	Monoterpene
Octanal	0.02	Aliphatic aldehyde
$\Delta^3$ -Carene	0.02	Monoterpene
$\alpha$ -Terpinene	0.01	Monoterpene
para-Cymene	0.12	Monoterpene
Limonene	0.18	Monoterpene
1,8-Cineole	0.67	Monoterpenic ether
(Z)- $\beta$ -Ocimene	0.01	Monoterpene
(E)- $\beta$ -Ocimene	0.04	Monoterpene
$\gamma$ -Terpinene	0.10	Monoterpene
cis-Linalool oxide (fur.)	0.01	Monoterpenic alcohol
Octanol	0.01	Aliphatic alcohol
Terpinolene isomer	0.02	Monoterpene
Terpinolene	0.01	Monoterpene
Linalool	0.04	Monoterpenic alcohol
(E)-4,8-Dimethylnona-1,3,7-triene	0.02	Terpene derivative
Geijerene	0.02	Terpene derivative
cis-para-Mentha-2,8-dien-1-ol	0.02	Monoterpenic alcohol
Isoborneol	0.23	Monoterpenic alcohol
Methylchavicol	0.18	Phenylpropanoid
trans-Carveol	0.02	Monoterpenic alcohol
cis-para-Mentha-1(7),8-dien-2-ol	0.02	Monoterpenic alcohol
Citronellol	0.77	Monoterpenic alcohol
Carvone	0.01	Monoterpenic ketone
Geraniol	1.01	Monoterpenic alcohol
Pregeijerene?	0.02	Unknown
$\alpha$ -Cubebene	0.16	Sesquiterpene
Eugenol	54.62	Phenylpropanoid
Dihydroeugenol	0.22	Phenylpropanoid
$\alpha$ -Copaene	0.48	Sesquiterpene
$\beta$ -Bourbonene	0.02	Sesquiterpene
cis- $\beta$ -Elemene	0.01	Sesquiterpene
$\beta$ -Cubebene	0.01	Sesquiterpene
$\beta$ -Elemene	0.05	Sesquiterpene
Isocaryophyllene	0.07	Sesquiterpene
Methyleugenol	0.02	Phenylpropanoid

$\beta$ -Caryophyllene	31.40	Sesquiterpene
Aromadendrene	0.06	Sesquiterpene
<i>trans</i> - $\alpha$ -Bergamotene	0.01	Sesquiterpene
<i>trans</i> -Muurolo-3,5-diene	0.05	Sesquiterpene
$\alpha$ -Humulene	4.93	Sesquiterpene
allo-Aromadendrene	0.02	Sesquiterpene
( <i>E</i> )- $\beta$ -Farnesene	0.03	Sesquiterpene
4,5-diepi-Aristolochene	0.02	Sesquiterpene
Selina-4,11-diene	0.09	Sesquiterpene
$\gamma$ -Muurolole	0.05	Sesquiterpene
Germacrene D	0.03	Sesquiterpene
$\beta$ -Selinene	0.07	Sesquiterpene
Bicyclogermacrene	0.04	Sesquiterpene
$\alpha$ -Selinene	0.07	Sesquiterpene
Germacrene A	0.08	Sesquiterpene
Cuparene	0.06	Sesquiterpene
$\gamma$ -Cadinene	0.08	Sesquiterpene
Cubebol	0.01	Sesquiterpenic alcohol
Kessane	0.14	Sesquiterpenic ether
$\delta$ -Cadinene	0.28	Sesquiterpene
<i>trans</i> -Calamenene	0.12	Sesquiterpene
Unknown	0.04	Sesquiterpene
$\alpha$ -Cadinene	0.01	Sesquiterpene
$\alpha$ -Calacorene	0.02	Sesquiterpene
Unknown	0.02	Unknown
Isocaryophyllene epoxide B	0.15	Sesquiterpenic ether
$\alpha$ -Elemol	0.08	Sesquiterpenic alcohol
$\beta$ -Calacorene	0.05	Sesquiterpene
( <i>E</i> )-Nerolidol	0.02	Sesquiterpenic alcohol
Caryolan-8-ol	0.02	Sesquiterpenic alcohol
Caryophyllene oxide isomer	tr	Sesquiterpenic ether
Caryophyllene oxide	0.59	Sesquiterpenic ether
Viridiflorol	0.01	Sesquiterpenic alcohol
Humulene epoxide I	0.04	Sesquiterpenic ether
Humulene epoxide II	0.10	Sesquiterpenic ether
Unknown	0.03	Oxygenated sesquiterpene
1-epi-Cubenol	0.02	Sesquiterpenic alcohol
$\gamma$ -Eudesmol	0.05	Sesquiterpenic alcohol
Caryophylladienol II	0.05	Sesquiterpenic alcohol
$\tau$ -Cadinol	0.02	Sesquiterpenic alcohol
$\tau$ -Muurolole	0.02	Sesquiterpenic alcohol
$\beta$ -Eudesmol	0.02	Sesquiterpenic alcohol
Neointermedeol	0.02	Sesquiterpenic alcohol
$\alpha$ -Cadinol	0.02	Sesquiterpenic alcohol
14-Hydroxy-( <i>Z</i> )-caryophyllene	0.08	Sesquiterpenic alcohol
(3 <i>Z</i> )-Caryophylla-3,8(13)-dien-5 $\beta$ -ol	0.05	Sesquiterpenic alcohol
Acorenone?	0.01	Sesquiterpenic ketone
Unknown	0.02	Oxygenated sesquiterpene
Unknown	0.03	Lignan
<b>Consolidated total</b>	<b>99.01%</b>	

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

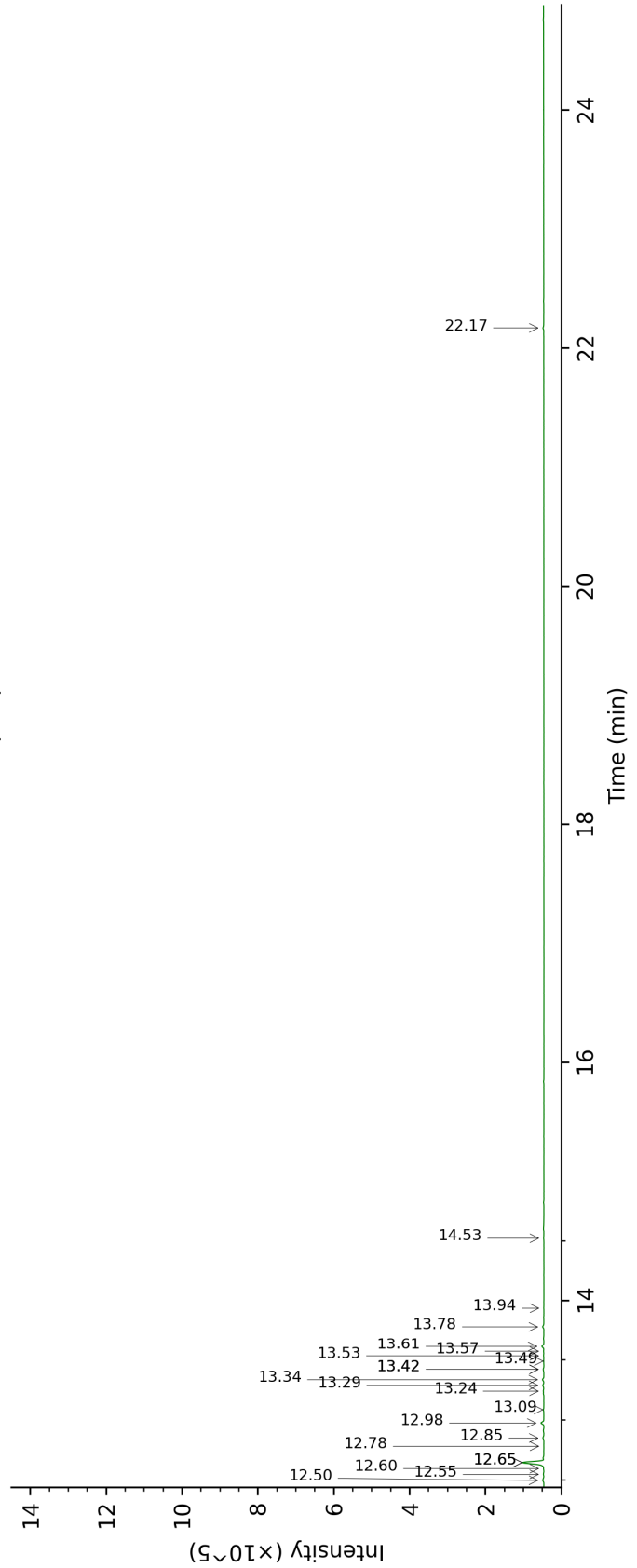
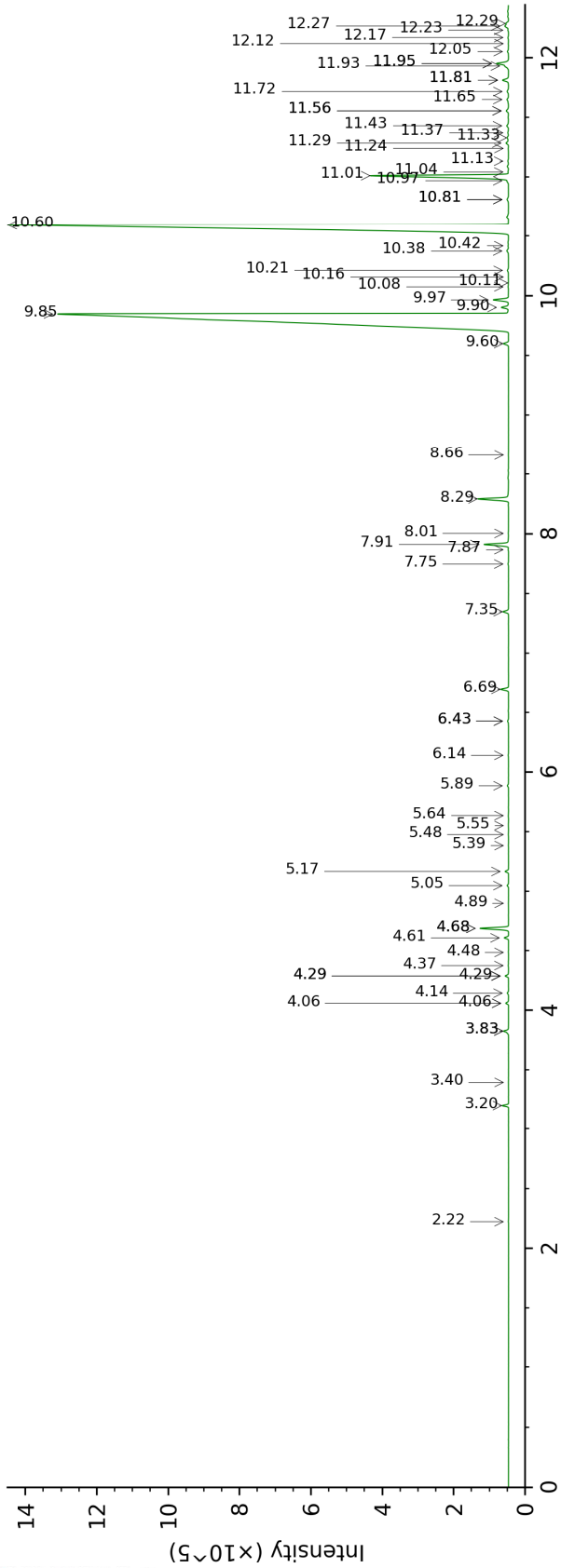
Note: no correction factor was applied

**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.

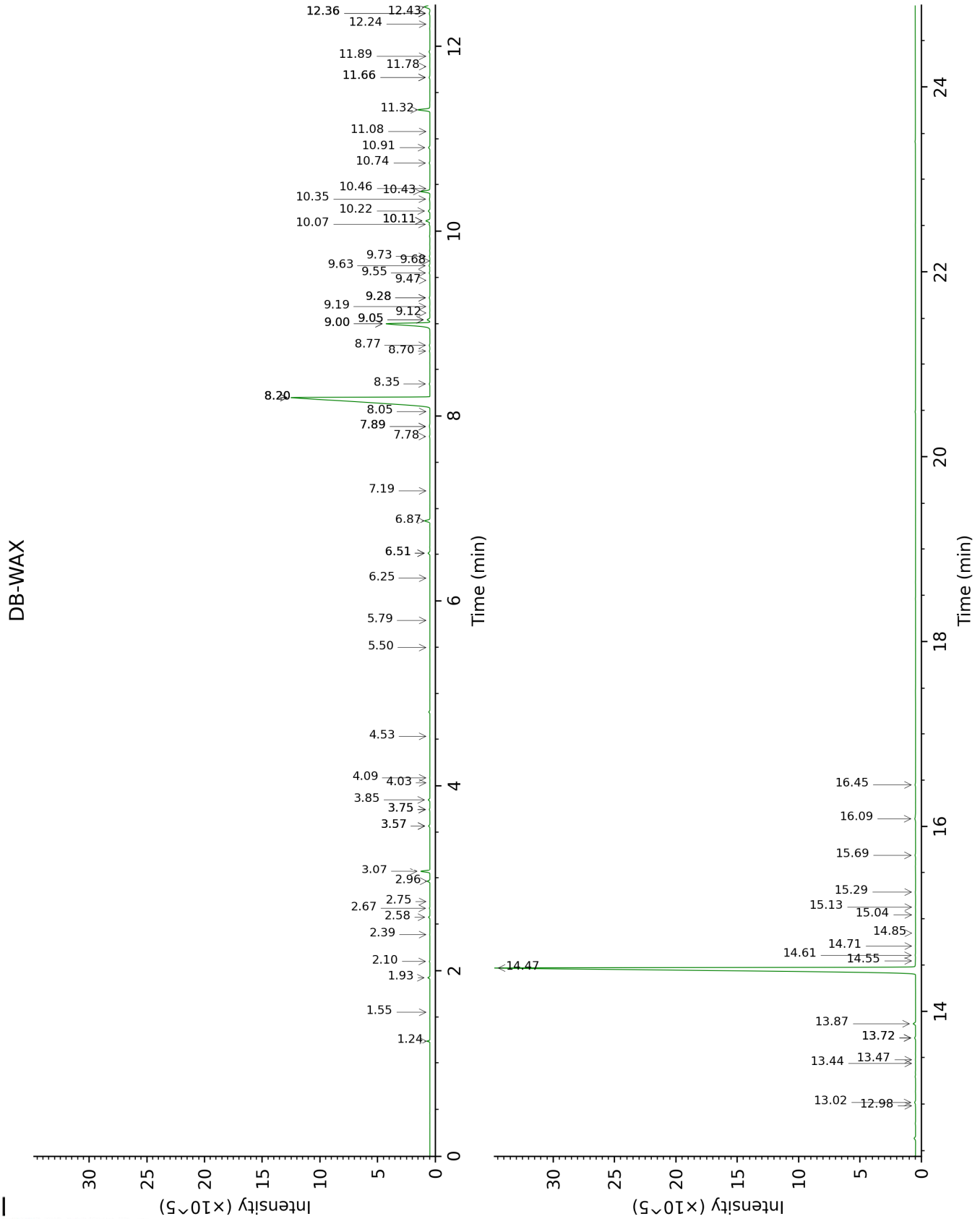
**Unknowns:** Unknown compounds' mass spectral data is presented in the "Full analysis data" table. The occurrence of unknown compounds is to be expected in many samples, and does not denote particular problems unless noted otherwise in the conclusion.

This page was intentionally left blank. The following pages present the complete data of the analysis.

DB-5



DB-WAX





## FULL ANALYSIS DATA

Identification	Column DB-5			Column DB-WAX		
	R.T	R.I	%	R.T	R.I	%
(3Z)-Hexenol	2.22	857	0.01	5.50	1344	0.01
$\alpha$ -Pinene	3.20	931	0.15	1.24	988	0.15
Camphene	3.40	943	0.01	1.55	1024	tr
Sabinene	3.83*	972	0.17	2.10	1081	0.04
$\beta$ -Pinene	3.83*	972	[0.17]	1.92	1063	0.13
Octen-3-ol	4.06*	987	0.08	6.52*	1418	0.16
Octan-3-one	4.06*	987	[0.08]	3.74*	1219	0.05
Myrcene	4.14	992	0.04	2.67	1132	0.04
Octan-3-ol	4.29*	1002	0.10	5.79	1365	0.01
$\alpha$ -Phellandrene	4.29*	1002	[0.10]	2.58	1124	0.09
Octanal	4.29*	1002	[0.10]	4.09	1245	0.02
$\Delta^3$ -Carene	4.37	1007	0.02	2.39	1109	0.01
$\alpha$ -Terpinene	4.48	1014	0.01	2.75	1138	0.01
para-Cymene	4.61	1022	0.12	3.85	1227	0.12
Limonene	4.68*	1027	0.84	2.96	1156	0.18
1,8-Cineole	4.68*	1027	[0.84]	3.07	1165	0.67
(Z)- $\beta$ -Ocimene	4.90	1040	0.01	3.57*	1205	0.10
(E)- $\beta$ -Ocimene	5.05	1050	0.04	3.74*	1219	[0.05]
$\gamma$ -Terpinene	5.17	1057	0.10	3.57*	1205	[0.10]
cis-Linalool oxide (fur.)	5.39	1071	0.01	6.25	1398	0.01
Octanol	5.48	1076	0.01	7.89*	1522	0.08
Terpinolene isomer	5.55	1081	0.02			
Terpinolene	5.64	1086	0.01	4.03	1241	0.01
Linalool	5.89	1102	0.04	7.78	1514	0.04
(E)-4,8-Dimethylnona-1,3,7-triene	6.14	1118	0.02	4.53	1280	0.02
Geijerene	6.43*	1136	0.04			
cis-para-Mentha-2,8-dien-1-ol	6.43*	1136	[0.04]	9.19	1625	0.02
Isoborneol	6.69	1153	0.23	9.05*	1614	0.23
Methylchavicol	7.35	1195	0.18	9.00*	1610	5.14
trans-Carveol	7.75	1221	0.02	11.08	1783	0.01
cis-para-Mentha-1(7),8-dien-2-ol	7.87	1229	0.02	11.66*	1835	0.07
Citronellol	7.91	1232	0.77	10.43	1728	0.79
Carvone	8.00	1238	0.01	9.68	1665	0.01
Geraniol	8.29	1258	1.01	11.32	1804	1.03
Pregeijerene?	8.66	1282	0.02			
$\alpha$ -Cubebene	9.60	1347	0.16	6.52*	1418	[0.16]
Eugenol	9.85	1364	54.62	14.47	2096	54.90
Dihydroeugenol	9.90	1368	0.22	13.87	2038	0.20
$\alpha$ -Copaene	9.97	1373	0.48	6.87	1445	0.47
$\beta$ -Bourbonene	10.08	1380	0.02	7.19	1469	0.02
cis- $\beta$ -Elemene	10.11	1383	0.01	8.05	1535	0.01

$\beta$ -Cubebene	10.16	1386	0.01			
$\beta$ -Elemene	10.21	1390	0.05	8.20*	1547	31.42
Isocaryophyllene	10.38	1402	0.07	7.89*	1522	[0.08]
Methyleugenol	10.42	1405	0.02	12.98	1954	0.01
$\beta$ -Caryophyllene	10.60	1418	31.40	8.20*	1547	[31.42]
Aromadendrene	10.81*	1434	0.07	8.35	1558	0.06
<i>trans</i> - $\alpha$ -Bergamotene	10.81*	1434	[0.07]	8.20*	1547	[31.42]
<i>trans</i> -Muurolo-3,5-diene	10.97	1446	0.05	8.70	1586	0.04
$\alpha$ -Humulene	11.01	1449	4.93	9.00*	1610	[5.14]
allo-Aromadendrene	11.04	1451	0.02	8.77	1591	0.05
( <i>E</i> )- $\beta$ -Farnesene	11.14	1458	0.03	9.28*	1633	0.06
4,5-diepi-Aristolochene	11.24	1466	0.02	9.12	1620	0.02
Selina-4,11-diene	11.29	1469	0.09	9.05*	1614	[0.23]
$\gamma$ -Muurolole	11.33	1472	0.05	9.28*	1633	[0.06]
Germacrene D	11.37	1476	0.03	9.47	1648	0.02
$\beta$ -Selinene	11.43	1480	0.07	9.55	1655	0.06
Bicyclogermacrene	11.56*	1489	0.09	9.73	1669	0.04
$\alpha$ -Selinene	11.56*	1489	[0.09]	9.63	1661	0.07
Germacrene A	11.65	1496	0.08	10.07	1698	0.07
Cuparene	11.72	1501	0.06	10.74	1754	0.06
$\gamma$ -Cadinene	11.81*	1508	0.21	10.11*	1701	0.36
Cubebol	11.81*	1508	[0.21]	12.24	1886	0.01
Kessane	11.93†	1518	0.54	10.22	1710	0.14
$\delta$ -Cadinene	11.95*†	1519	[0.54]	10.11*	1701	[0.36]
<i>trans</i> -Calamenene	11.95*†	1519	[0.54]	10.91	1769	0.12
Unknown [m/z 119, 105 (53), 161 (33), 93 (28), 91 (25), 40 (20)...204]	12.05	1527	0.04	10.35	1721	0.07
$\alpha$ -Cadinene	12.12	1532	0.01	10.46	1730	0.02
$\alpha$ -Calacorene	12.17	1536	0.02	11.78	1845	0.02
Unknown [m/z 164, 135 (98), 93 (86), 107 (83), 79 (69)...]	12.23	1541	0.02	11.66*	1835	[0.07]
Isocaryophyllene epoxide B	12.27	1544	0.15	11.89	1855	0.01
$\alpha$ -Elemol	12.29	1546	0.08	13.72*	2024	0.09
$\beta$ -Calacorene	12.50	1562	0.05	12.36*	1896	0.07
( <i>E</i> )-Nerolidol	12.55	1566	0.02	13.48	2000	0.02
Caryolan-8-ol	12.60	1570	0.02	12.36*	1896	[0.07]
Caryophyllene oxide isomer	12.65*	1574	0.78	12.36*	1896	[0.07]
Caryophyllene oxide	12.65*	1574	[0.78]	12.42	1903	0.59
Viridiflorol	12.78	1585	0.01	13.72*	2024	[0.09]

Humulene epoxide I	12.85	1590	0.04			
Humulene epoxide II	12.98	1600	0.10	13.02	1958	0.09
Unknown [m/z 43, 81 (97), 135 (71), 95 (62), 204 (61), 71 (59), 207 (56)... 222 (3)]	13.09	1608	0.03			
1-epi-Cubenol	13.24	1621	0.02	13.44	1996	0.02
γ-Eudesmol	13.29	1625	0.05	14.61	2110	0.04
Caryophylladienol II	13.34	1629	0.05	15.69	2220	0.05
τ-Cadinol	13.42*	1636	0.04	14.55	2104	0.02
τ-Muurolol	13.42*	1636	[0.04]	14.71	2120	0.02
β-Eudesmol	13.49	1642	0.02	15.04	2154	0.01
Neointermedeol	13.53	1645	0.02	15.29	2179	0.03
α-Cadinol	13.57	1649	0.02	15.13	2162	0.02
14-Hydroxy-(Z)-caryophyllene	13.61	1652	0.08	16.09	2261	0.12
(3Z)-Caryophylla-3,8(13)-dien-5β-ol	13.78	1666	0.05	16.45	2300	0.05
Acorenone?	13.94	1679	0.01	14.85	2134	0.01
Unknown [m/z 43, 93 (76), 95 (75), 109 (62), 107 (60), 79 (53)...]	14.53	1728	0.02			
Unknown [m/z 326, 148 (67), 147 (41), 117 (30), 91 (22)...]	22.17	2500	0.03			
<b>Total identified</b>		<b>99.15%</b>			<b>98.73%</b>	
<b>Total reported</b>		<b>99.29%</b>			<b>98.80%</b>	

\*: 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