



## GC/MS BATCH NUMBER: TK0106

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**ESSENTIAL OIL:** TURMERIC C02 ORGANIC  
**BOTANICAL NAME:** CURCUMA LONGA  
**ORIGIN:** INDONESIA

KEY CONSTITUENTS PRESENT IN THIS BATCH OF TURMERIC C02 ORGANIC OIL	%
$\alpha$ -TURMERONE	25.4
$\alpha$ r-TURMERONE	20.0
$\beta$ -TURMERONE	16.3
$\beta$ -SESQUIPHELLANDRENE	2.0
$\alpha$ -ZINGIBERENE	2.0
$\alpha$ r-CURCUMENE	1.9
$\alpha$ -PHELLANDRENE	1.3

Comments from Robert Tisserand: Rich, sweet, spicy-woody-rooty odor quality. Constituents are in expected amounts.

**Date :** March 15, 2018

*CERTIFICATE OF ANALYSIS - GC PROFILING*

*SAMPLE IDENTIFICATION*

**Internal code :** 18C14-PTH1-1-CC

**Customer identification :** Tumeric Organic CO2 - Indonesia - TK010671R

**Type :** CO2 extract

**Source :** *Curcuma longa*

**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 :** March 15, 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:** Bright yellow liquid

**Refractive index:**  $1.5115 \pm 0.0003$  (20 °C)

*CONCLUSION*

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

ANALYSIS SUMMARY

Identification	DB-5 (%)	DB-WAX (%)	Classe
Toluene	0.01	0.01*	Simple phenolic
$\alpha$ -Thujene	tr	[0.01]*	Monoterpene
$\alpha$ -Pinene	0.06	0.06	Monoterpene
Camphene	0.01*	0.01	Monoterpene
$\alpha$ -Fenchene	[0.01]*	tr	Monoterpene
Sabinene	tr	tr	Monoterpene
6-Methyl-5-hepten-2-one	tr	tr	Aliphatic ketone
Myrcene	0.06	0.06	Monoterpene
$\alpha$ -Phellandrene	1.27	1.31	Monoterpene
$\Delta^3$ -Carene	0.03	0.03	Monoterpene
$\alpha$ -Terpinene	0.03	0.03	Monoterpene
para-Cymene	0.43	0.45	Monoterpene
Limonene	0.85*	0.12	Monoterpene
1,8-Cineole	[0.85]*	0.78	Monoterpenic ether
(Z)- $\beta$ -Ocimene	tr	tr	Monoterpene
(E)- $\beta$ -Ocimene	tr	0.01	Monoterpene
$\gamma$ -Terpinene	0.06	0.06	Monoterpene
Terpinolene	0.31	0.32	Monoterpene
Linalool	0.01	0.01	Monoterpenic alcohol
Unknown	0.01	tr	Oxygenated monoterpene
Unknown	tr	tr	Oxygenated monoterpene
cis-para-Menth-2-en-1-ol	0.01	0.01	Monoterpenic alcohol
Camphor	0.05	0.06	Monoterpenic ketone
Unknown	0.01	0.01	Oxygenated monoterpene
Borneol	0.01	0.06*	Monoterpenic alcohol
$\delta$ -Terpineol	0.01	0.02*	Monoterpenic alcohol
Terpinen-4-ol	0.04	0.04	Monoterpenic alcohol
4-Methylacetophenone	0.01	0.02	Simple phenolic
para-Cymen-8-ol	0.05	0.05	Monoterpenic alcohol
$\alpha$ -Terpineol	0.07	[0.06]*	Monoterpenic alcohol
$\alpha$ -Phellandrene epoxide	0.07	0.06	Monoterpenic ether
trans-Piperitol	0.01	0.75*	Monoterpenic alcohol
Unknown	0.01	0.01	Oxygenated monoterpene
Unknown	tr	0.08	Oxygenated monoterpene
Carvotanacetone	tr	tr	Monoterpenic ketone
Unknown	0.03		Monoterpenic ester
Thymol	0.05	1.28*	Monoterpenic alcohol
Carvacrol	0.03	0.85*	Monoterpenic alcohol
Unknown	0.10	0.16	Unknown
Unknown	0.02	0.01	
Unknown	tr		Unknown
Unknown	0.01	0.01	Terpene derivative
Unknown	0.06	0.04	Terpene derivative
Unknown	0.04	0.06	Terpene derivative
Unknown	0.10	1.16	Unknown
Unknown	0.02	0.03	Sesquiterpene
Acora-3,7(14)-diene	0.08	0.06	Sesquiterpene
(Z?)-Vestitenone, or analog	0.01	tr	Terpenic ketone

β-Caryophyllene	0.40	0.41*	Sesquiterpene
α-Santalene	0.01	0.01	Sesquiterpene
(trans?)-6-Hydroxypiperitone	0.05	0.12	Monoterpenic alcohol
(cis?)-6-Hydroxypiperitone	0.01	0.91*	Monoterpenic alcohol
γ-Elemene	0.03	0.02	Sesquiterpene
trans-α-Bergamotene	0.02	[0.41]*	Sesquiterpene
Unknown	0.28		Unknown
(E)-Vestitenone	0.01	0.01	Terpenic ketone
α-Humulene	0.06	0.05	Sesquiterpene
Unknown	0.01	[0.02]*	Sesquiterpene
(E)-β-Farnesene	0.04	0.06	Sesquiterpene
β-Acoradiene	0.20	0.28	Sesquiterpene
γ-Curcumene	0.11	0.10	Sesquiterpene
ar-Curcumene	1.86	[3.91]	Sesquiterpene
α-Zingiberene	1.96	1.93	Sesquiterpene
Unknown	0.05	0.14	Sesquiterpene
β-Bisabolene	0.38	0.39	Sesquiterpene
β-Curcumene	0.82*	[0.75]*	Sesquiterpene
Unknown	[0.82]*		Oxygenated sesquiterpene
Unknown	0.01		Oxygenated sesquiterpene
β-Sesquiphellandrene	2.03	3.91*	Sesquiterpene
Selina-4(15),7(11)-diene	0.16	0.12	Sesquiterpene
(E)-γ-Bisabolene	0.11	[0.75]*	Sesquiterpene
Selina-3,7(11)-diene	0.06	[3.91]*	Sesquiterpene
Unknown	0.20*	0.03	Sesquiterpene
cis-Sesquisabinene hydrate	[0.20]*	0.15	Sesquiterpenic alcohol
Unknown	0.12	0.09	Oxygenated sesquiterpene
(E)-Nerolidol	0.09	0.06	Sesquiterpenic alcohol
Unknown	0.13		Unknown
Unknown	0.27*	0.19	Oxygenated sesquiterpene
Caryophyllene oxide	[0.27]*	0.05	Sesquiterpenic ether
Caryophyllene oxide isomer	[0.27]*	tr	Sesquiterpenic ether
ar-Turmerol	0.83	[0.85]*	Sesquiterpenic alcohol
trans-Sesquisabinene hydrate	0.30*	0.20	Sesquiterpenic alcohol
Unknown	[0.30]*		Oxygenated sesquiterpene
ar-Dihydroturmerone	0.06	0.08	Sesquiterpenic ketone
cis-Zingiberenol	0.51	0.42	Sesquiterpenic alcohol
trans-Zingiberenol	0.58	[1.28]*	Sesquiterpenic alcohol
Unknown	0.20	0.13	Oxygenated sesquiterpene
Unknown	0.37	0.45*	Oxygenated sesquiterpene
ar-Turmerone	45.29*	20.01	Sesquiterpenic ketone
α-Turmerone	[45.29]*	25.36	Sesquiterpenic ketone
Unknown	[45.29]	[0.45]*	Oxygenated sesquiterpene
Unknown	0.38	0.24	Oxygenated sesquiterpene
β-Turmerone	16.32	16.02*	Sesquiterpenic ketone
(Z)-α-Atlantone	0.22	[16.02]*	Sesquiterpenic ketone
Curcuphenol	0.13	0.19	Sesquiterpenic alcohol
(6S,7R)-Bisabolone	0.83	0.89	Sesquiterpenic ketone
Xanthorizzhol?	1.28		Sesquiterpenic alcohol
Unknown	1.05	[0.91]*	Oxygenated sesquiterpene
Unknown	1.14		Oxygenated sesquiterpene
(E)-α-Atlantone	0.94	0.95	Sesquiterpenic ketone

Unknown	0.54	0.56	Oxygenated sesquiterpene
Unknown	0.48	0.67	Oxygenated sesquiterpene
Unknown	1.55		Unknown
Unknown	0.18	0.18	Oxygenated sesquiterpene
Unknown	0.12		Oxygenated sesquiterpene
Unknown	0.13		Oxygenated sesquiterpene
Unknown	0.10		Oxygenated sesquiterpene
Unknown	0.63		Oxygenated sesquiterpene
Unknown	0.05		Oxygenated sesquiterpene
Unknown	0.04		Oxygenated sesquiterpene
Unknown	0.45		Oxygenated sesquiterpene
Unknown	0.66		Oxygenated sesquiterpene
Unknown	0.54	0.61	Oxygenated sesquiterpene
Unknown	0.05		Oxygenated sesquiterpene
<b>Total identified</b>	<b>75.87%</b>	<b>79.68%</b>	

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

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

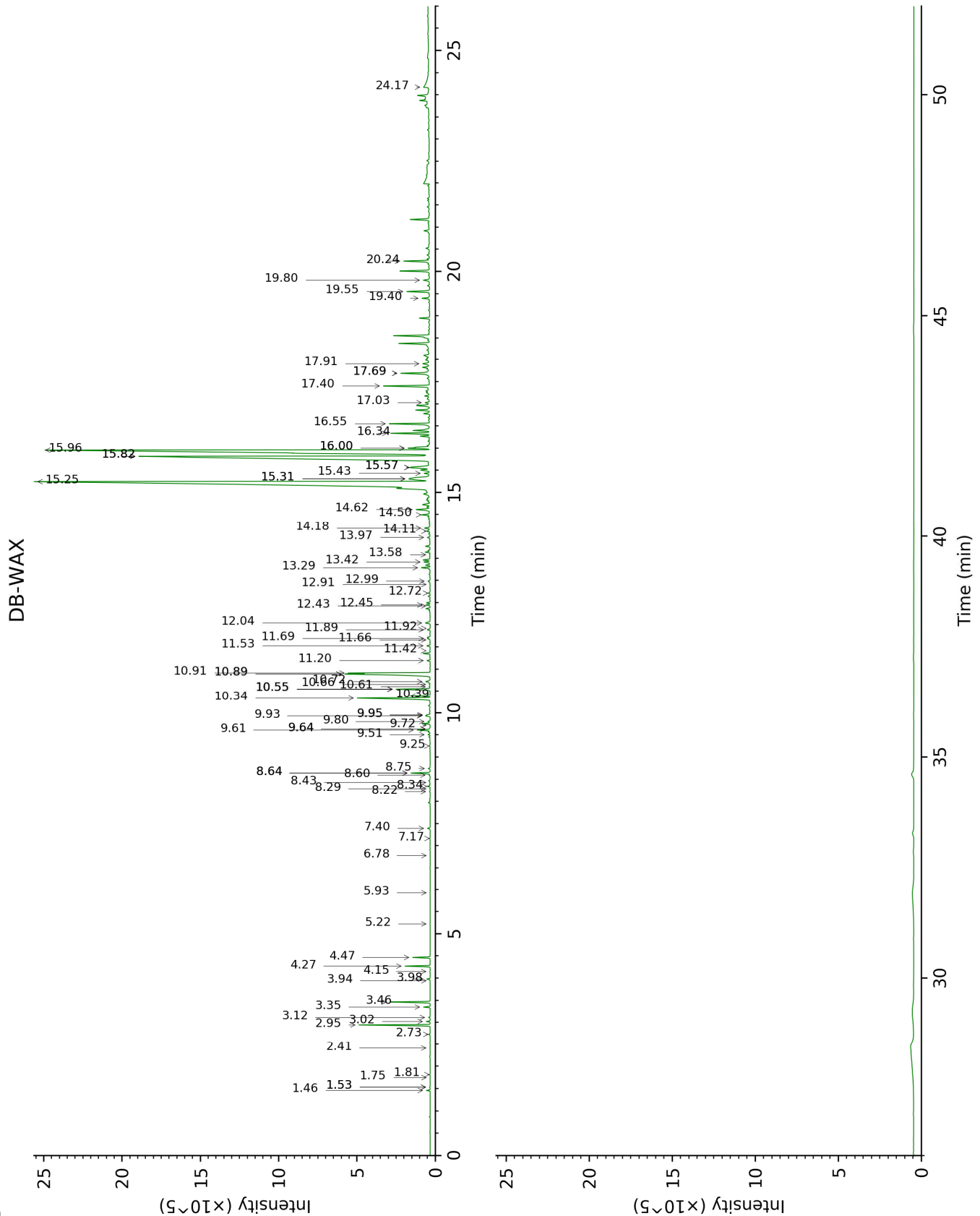
tr: The compound has been detected below 0.005% of total signal.

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	%
Toluene	1.12	754	0.01	1.54*	1003	0.01
α-Thujene	2.93	922	tr	1.54*	1003	[0.01]
α-Pinene	3.00	927	0.06	1.46	995	0.06
Camphene	3.20*	940	0.01	1.82	1030	0.01
α-Fenchene	3.20*	940	[0.01]	1.75	1023	tr
Sabinene	3.61	967	tr	2.41	1087	tr
6-Methyl-5-hepten-2-one	3.87	984	tr	5.22	1297	tr
Myrcene	3.94	989	0.06	3.02	1136	0.06
α-Phellandrene	4.10	1000	1.27	2.95	1130	1.31
Δ <sup>3</sup> -Carene	4.17	1004	0.03	2.73	1114	0.03
α-Terpinene	4.28	1011	0.03	3.12	1143	0.03
para-Cymene	4.41	1019	0.43	4.27	1229	0.45
Limonene	4.49*	1024	0.85	3.35	1161	0.12
1,8-Cineole	4.49*	1024	[0.85]	3.46	1169	0.78
(Z)-β-Ocimene	4.69	1037	tr	3.94	1205	tr
(E)-β-Ocimene	4.84	1047	tr	4.15	1220	0.01
γ-Terpinene	4.96	1054	0.06	3.98	1208	0.06
Terpinolene	5.42	1083	0.31	4.47	1243	0.32
Linalool	5.69	1100	0.01	8.22	1516	0.01
Unknown [m/z 95, 150 (45), 110 (35), 107 (23), 109 (21)]	5.74	1103	0.01	5.93	1347	tr
Unknown [m/z 83, 55 (30), 135 (15), 109 (12), 150 (12)]	5.88	1112	tr	6.78	1408	tr
cis-para-Menth-2-en-1-ol	5.95	1117	0.01	8.29	1521	0.01
Camphor	6.22	1134	0.05	7.40	1454	0.06
Unknown [m/z 95, 43 (74), 109 (72), 82 (62), 110 (50)... 152 (14)]	6.32	1140	0.01	7.17	1437	0.01
Borneol	6.63	1160	0.01	9.95*	1652	0.06
δ-Terpineol	6.67	1163	0.01	9.64*	1626	0.02
Terpinen-4-ol	6.81	1172	0.04	8.75	1556	0.04
4-Methylacetophenone	6.88	1176	0.01	10.66	1709	0.02
para-Cymen-8-ol	6.99	1183	0.05	11.69	1797	0.05
α-Terpineol	7.05	1187	0.07	9.95*	1652	[0.06]
α-Phellandrene epoxide	7.20	1197	0.07	11.20	1755	0.06
trans-Piperitol	7.31	1204	0.01	10.55*	1700	0.75
Unknown [m/z 43, 111 (88), 126 (74), 125 (61)... 168? (2)]	7.48	1215	0.01	11.42	1774	0.01
Unknown [m/z 137, 152 (28), 43 (25), 91 (24), 109 (23), 119	7.73	1232	tr	11.53	1783	0.08

(19)]						
Carvotanacetone	7.85	1240	tr	9.72	1633	tr
Unknown [m/z 93, 43 (60), 108 (58), 69 (36), 41 (35)... 150 (5), 184 (1)]	8.60	1290	0.03			
Thymol	8.77	1301	0.05	15.31*	2133	1.28
Carvacrol	8.82	1305	0.03	15.57*	2159	0.85
Unknown [m/z 111, 126 (93), 43 (90), 71 (60)...]	8.97	1315	0.10	15.43	2146	0.16
Unknown [m/z 43, 97 (99), 107 (47), 41 (35), 55 (30)...]	9.20	1332	0.02	13.58	1967	0.01
Unknown [m/z 133, 105 (45), 91 (38), 119 (36)... 150 (3)]	9.32	1340	tr			
Unknown [m/z 105, 91 (66), 120 (53), 93 (48), 77 (47), 71 (46), 43 (37), 145 (22)... 178 (2)]	9.71	1368	0.01	11.66	1794	0.01
Unknown [m/z 119, 161 (36), 43 (33), 176 (26), 91 (24), 105 (22)]	9.79	1374	0.06	12.72	1887	0.04
Unknown [m/z 43, 105 (50), 120 (40), 145 (36), 119 (33), 93 (30)... 176 (6)]	9.96	1386	0.04	11.89	1814	0.06
Unknown [m/z 71, 100 (92), 111 (79), 69 (46), 109 (45)...]	10.07	1393	0.10	17.40	2351	1.16
Unknown [m/z 119, 93 (83), 91 (51), 77 (32), 41 (31)... 202 (16)]	10.12	1397	0.02	8.60	1545	0.03
Acora-3,7(14)-diene	10.19	1402	0.08	8.34	1525	0.06
(Z?)-Vestitenone, or analog	10.24	1405	0.01	11.92	1817	tr
β-Caryophyllene	10.30	1409	0.40	8.64*	1548	0.41
α-Santalene	10.35	1413	0.01	8.43	1532	0.01
(trans?)-6-Hydroxypiperitone	10.39	1416	0.05	17.03	2310	0.12
(cis?)-6-Hydroxypiperitone	10.44	1420	0.01	17.69*	2382	0.91
γ-Elemene	10.53	1427	0.03	9.25	1595	0.02
trans-α-Bergamotene	10.57	1430	0.02	8.64*	1548	[0.41]
Unknown [m/z 91, 129 (98), 143 (94), 185 (81), 200 (76)...]	10.67	1437	0.28			
(E)-Vestitenone	10.70	1440	0.01	12.43	1862	0.01
α-Humulene	10.76	1444	0.06	9.51	1616	0.05

Unknown [m/z 69, 91 (78), 109 (54), 202 (43), 41 (36), 120 (34)]	10.82	1449	0.01	9.64*	1626	[0.02]
(E)-β-Farnesene	10.88	1453	0.04	9.80	1640	0.06
β-Acoradiene	10.90	1455	0.20	9.61	1624	0.28
γ-Curcumene	11.17	1474	0.11	9.93	1650	0.10
α-Curcumene	11.24	1480	1.86	10.91†	1731	[3.91]
α-Zingiberene	11.42	1493	1.96	10.34	1683	1.93
Unknown [m/z 119, 91 (14), 120 (10), 117 (9)... 200? (2)]	11.52	1501	0.05	12.04	1828	0.14
β-Bisabolene	11.57	1504	0.38	10.39	1687	0.39
β-Curcumene	11.62*	1508	0.82	10.55*	1700	[0.75]
Unknown [m/z 93, 91 (62), 119 (57), 105 (44), 43 (43)... 220? (1)]	11.62*	1508	[0.82]			
Unknown [m/z 121, 93 (56), 91 (12), 94 (11), 122 (10)...220]	11.69	1514	0.01			
β-Sesquiphellandrene	11.78	1521	2.03	10.89*†	1729	3.91
Selina-4(15),7(11)-diene	11.82	1524	0.16	10.72	1715	0.12
(E)-γ-Bisabolene	11.85	1526	0.11	10.55*	1700	[0.75]
Selina-3,7(11)-diene	11.91	1531	0.06	10.89*†	1729	[3.91]
Unknown [m/z 91, 93 (82), 79 (79), 77 (68), 67 (55), 41 (49)... 202 (12)]	12.10*	1546	0.20	10.60	1705	0.03
cis-Sesquisabinene hydrate	12.10*	1546	[0.20]	13.42	1952	0.15
Unknown [m/z 138, 96 (100), 95 (85), 109 (74), 110 (60), 105 (57)... 220 (10)]	12.21	1555	0.12	12.45	1864	0.09
(E)-Nerolidol	12.29	1561	0.09	13.97	2003	0.06
Unknown [m/z 109, 67 (30), 43 (24), 91 (19)...]	12.31	1562	0.13			
Unknown [m/z 105, 83 (65), 120 (41), 119 (35), 91 (29), 55 (22)... 218? (t)]	12.43*	1572	0.27	13.29	1940	0.19
Caryophyllene oxide	12.43*	1572	[0.27]	12.99	1912	0.05
Caryophyllene oxide isomer	12.43*	1572	[0.27]	12.91	1905	tr
α-Turmerol	12.49	1577	0.83	15.57*	2159	[0.85]
trans-Sesquisabinene hydrate	12.61*	1586	0.30	14.50	2054	0.20
Unknown [m/z 43, 91 (63), 41 (61), 79 (58),	12.61*	1586	[0.30]			

95 (49), 93 (47)... 202 (36)...						
ar-Dihydroturmerone	12.63	1587	0.06	14.11	2017	0.08
cis-Zingiberenol	12.91	1610	0.51	14.62	2065	0.42
trans-Zingiberenol	13.12	1628	0.58	15.31*	2133	[1.28]
Unknown [m/z 120, 91 (29), 43 (25), 93 (23), 77 (21)... 218 (1)]	13.16	1630	0.20	14.18	2023	0.13
Unknown [m/z 83, 109 (45), 43 (43), 55 (36), 41 (35)... 220 (3)]	13.29	1641	0.37	16.00*	2203	0.45
ar-Turmerone	13.74*†	1678	45.29	15.96	2198	20.01
α-Turmerone	13.74*†	1678	[45.29]	15.25	2127	25.36
Unknown [m/z 69, 41 (90), 123 (74), 122 (51)... 206 (14), 218 (2)]	13.76†	1680	[45.29]	16.00*	2203	[0.45]
Unknown [m/z 199, 132 (99), 59 (25), 91 (20), 117 (19), 43 (14)... 216? (6)]	13.94	1695	0.38	17.91	2406	0.24
β-Turmerone	14.10	1708	16.32	15.82*	2184	16.02
(Z)-α-Atlantone	14.11	1710	0.22	15.82*	2184	[16.02]
Curcuphenol	14.17	1715	0.13	19.40	2575	0.19
(6S,7R)-Bisabolone	14.49	1742	0.83	16.34	2238	0.89
Xanthorizzhol?	14.60	1752	1.28			
Unknown [m/z 83, 55 (21), 43 (13), 41 (9), 91 (8)... 234? (1)]	14.68	1758	1.05	17.69*	2382	[0.91]
Unknown [m/z 119, 83 (30), 91 (14), 120 (11), 114 (9)... 234 (1)]	14.75	1765	1.14			
(E)-α-Atlantone	14.83	1771	0.94	16.55	2260	0.95
Unknown [m/z 95, 136 (77), 83 (68), 125 (55), 109 (40), 110 (39)... 234 (7)]	15.01	1787	0.54	19.55	2593	0.56
Unknown [m/z 69, 43 (95), 41 (84), 109 (78), 95 (54), 93 (49)... 177 (36), 220 (2)...]	15.13	1797	0.48	20.24	2675	0.67
Unknown [m/z 83, 121 (74), 114 (74), 93 (40), 55 (20), 91 (20)...]	15.23	1806	1.55			
Unknown [m/z 83, 119 (56), 95 (53), 234 (32), 91 (30)]	15.32	1814	0.18	19.80	2624	0.18
Unknown [m/z 83, 136 (51), 43 (46), 109 (29), 55 (26), 119 (22)...234 (1)]	15.50	1831	0.12			

Unknown [m/z 83, 136 (36), 55 (26), 109 (21), 79 (17), 43 (16)... 232 (11)]	15.56	1837	0.13			
Unknown [m/z 83, 107 (37), 43 (32), 135 (30), 55 (27)...]	15.76	1854	0.10			
Unknown [m/z 83, 43 (24), 55 (21), 109 (15), 135 (14)... 232 (1)]	16.02	1878	0.63			
Unknown [m/z 83, 55 (15), 43 (14), 91 (8)... 232 (1)]	16.45	1918	0.05			
Unknown [m/z 83, 149 (24), 135 (24), 55 (24), 43 (13)... 232 (3)]	16.64	1936	0.04			
Unknown [m/z 83, 55 (18), 43 (14), 84 (6)... 232 (t)]	16.68	1939	0.45			
Unknown [m/z 83, 55 (22), 43 (22), 119 (19), 41 (10)...]	17.06	1975	0.66			
Unknown [m/z 83, 43 (22), 55 (20), 98 (14), 119 (14)...]	17.15	1985	0.54	24.17	3192	0.61
Unknown [m/z 83, 135 (32), 55 (26), 125 (18), 41 (13), 109 (12)... 248 (1)]	17.87	2055	0.05			
<b>Total identified</b>		<b>75.87%</b>			<b>79.68%</b>	
<b>Total reported</b>		<b>89.50%</b>			<b>84.09%</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