

Date : January 4, 2021

CERTIFICATE OF ANALYSIS – GC PROFILING

SAMPLE IDENTIFICATION

Internal code : 20L08-PTH06

Customer identification : Turmeric CO2 ORGANIC - TK0109203R

Type : CO2 extract

Source : Curcuma longa

Customer : Plant Therapy

ANALYSIS

Method: Dilution of a known amount with an appropriate solvent, and addition of a methyl octanoate internal standard for quantitation. Application of a correction factor¹. Analysis with PC-MAT-004 - Terpenes and volatiles profiling by response factor (in French); identifications validated by GC-MS.

Analyst : Sylvain Mercier, M. Sc., Chimiste

Analysis date : December 10, 2020

Checked and approved by :

Sylvain Mercier, M. Sc., chimiste 2014-005

Notes: This report may not be published, including online, without the written consent from Laboratoire PhytoChemia.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

This report is an update of the version first issued on December 14, 2020 to correct a mistake in the lot number.

REFERENCE

- (1) Cachet, T.; Brevard, H.; Chaintreau, A.; Demyttenaere, J.; French, L.; Gassenmeier, K.; Joulain, D.; Koenig, T.; Leijis, H.; Liddle, P.; et al. IOFI Recommended Practice for the Use of Predicted Relative-Response Factors for the Rapid Quantification of Volatile Flavouring Compounds by GC-FID. *Flavour Fragr. J.* 2016, 31 (3), 191–194.

*P*HYSICO*C*HEMICAL *D*ATA

Physical aspect: Very bright yellow liquid

Refractive index: 1.5149 ± 0.0003 (20 °C; method PC-MAT-016)

*C*ONCLUSION

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

ANALYSIS SUMMARY

Identification	(mg/g)	% of total volatiles	Classe
α-Pinene	0.78	0.08	Monoterpene
Camphene	0.08	0.01	Monoterpene
β-Pinene	0.22	0.02	Monoterpene
Myrcene	0.59	0.06	Monoterpene
α-Phellandrene	7.56	0.82	Monoterpene
Δ3-Carene	0.34	0.04	Monoterpene
α-Terpinene	0.26	0.03	Monoterpene
para-Cymene	6.30	0.69	Monoterpene
Limonene	1.28	0.14	Monoterpene
1,8-Cineole	12.96	1.41	Monoterpenic ether
γ-Terpinene	0.36	0.04	Monoterpene
Terpinolene	1.22	0.13	Monoterpene
Linalool	0.50	0.05	Monoterpenic alcohol
cis-para-Menth-2-en-1-ol	0.22	0.02	Monoterpenic alcohol
δ-Terpineol	0.24	0.03	Monoterpenic alcohol
Terpinen-4-ol	0.68	0.07	Monoterpenic alcohol
4-Methylacetophenone	0.22	0.02	Simple phenolic
para-Cymen-8-ol	0.75	0.08	Monoterpenic alcohol
α-Terpineol	1.06	0.12	Monoterpenic alcohol
cis-α-Phellandrene epoxide (IPP vs Me)	1.16	0.13	Monoterpenic ether
Unknown	0.25	0.03	Monoterpenic ester
Thymol	0.52	0.06	Monoterpenic alcohol
Carvacrol	0.52	0.06	Monoterpenic alcohol
para-Menth-5-en-1,2-diol isomer III	1.26	0.14	Monoterpenic alcohol
Unknown	0.22	0.02	Terpene derivative
Unknown	0.30	0.03	Terpene derivative
Unknown	1.18	0.13	Unknown
Unknown	0.43	0.05	Sesquiterpene
(Z?)-Vestitenone, or analog	0.77	0.08	Terpenic ketone
β-Caryophyllene	2.00	0.22	Sesquiterpene
(E)-Vestitenone	1.07	0.12	Terpenic ketone
Unknown	3.75	0.41	Unknown
α-Humulene	0.46	0.05	Sesquiterpene
Unknown	1.22	0.13	Sesquiterpene
(E)-β-Farnesene	1.42	0.15	Sesquiterpene
β-Acoradiene	0.30	0.03	Sesquiterpene
γ-Curcumene	0.87	0.09	Sesquiterpene
α-Curcumene	18.22	1.98	Sesquiterpene
trans-β-Bergamotene	0.39	0.04	Sesquiterpene
Unknown	0.74	0.08	Sesquiterpene
α-Zingiberene	9.29	1.01	Sesquiterpene
β-Bisabolene	3.67	0.40	Sesquiterpene
β-Curcumene	0.62	0.07	Sesquiterpene
Unknown	0.60	0.07	Oxygenated sesquiterpene
Unknown	0.24	0.03	Oxygenated sesquiterpene
β-Sesquiphellandrene	18.42	2.00	Sesquiterpene
Unknown	2.07	0.23	Sesquiterpene

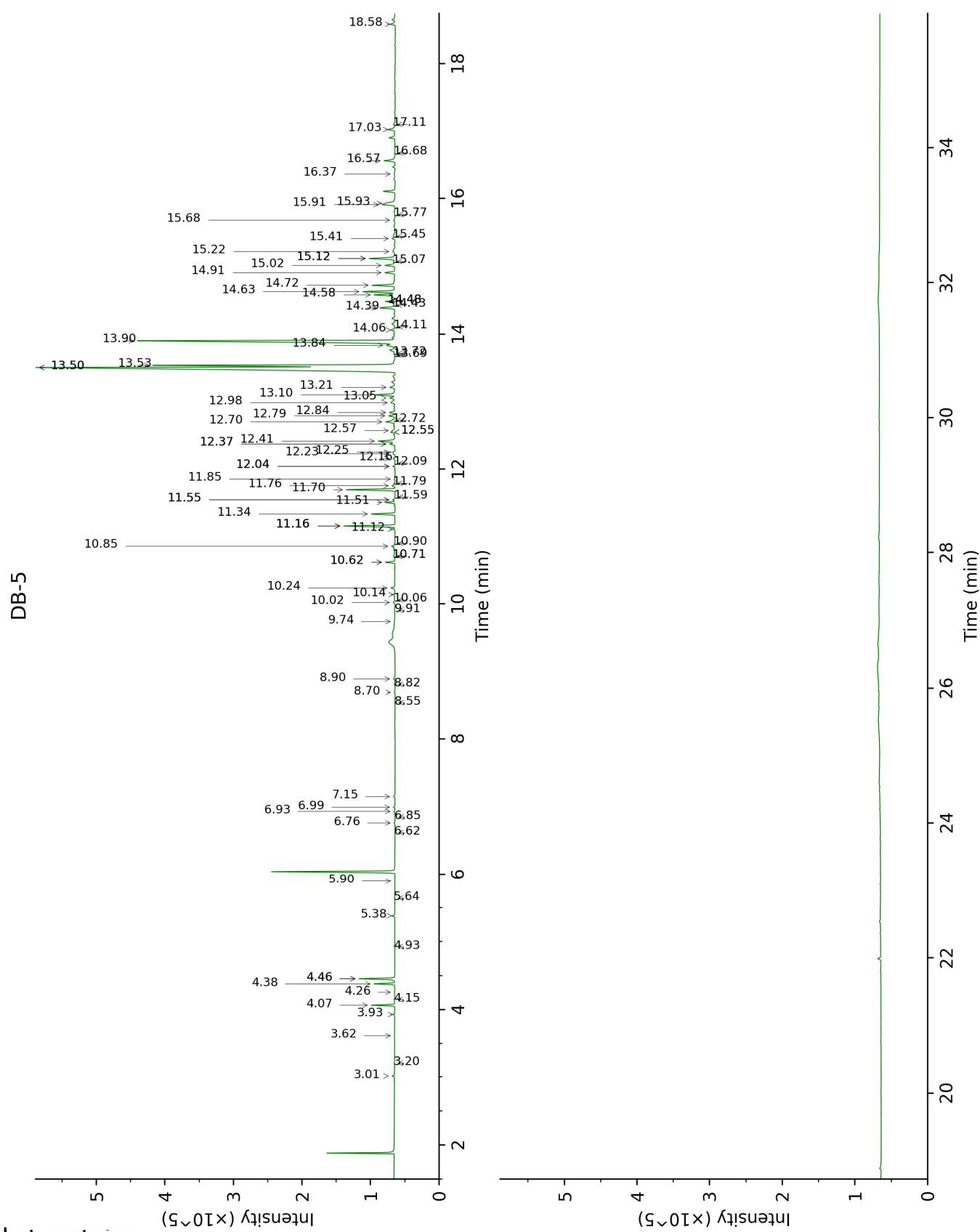
Selina-4(15),7(11)-diene	0.66	0.07	Sesquiterpene
Selina-3,7(11)-diene	0.56	0.06	Sesquiterpene
Unknown	0.95	0.10	Sesquiterpene
Germacrene B	0.24	0.03	Sesquiterpene
cis-Sesquisabinene hydrate	0.30	0.03	Sesquiterpenic alcohol
Unknown	1.40	0.15	Oxygenated sesquiterpene
Unknown	1.35	0.15	Unknown
(E)-Nerolidol	1.13	0.12	Sesquiterpenic alcohol
Unknown	2.27	0.25	Oxygenated sesquiterpene
Caryophyllene oxide	0.69	0.08	Sesquiterpenic ether
ar-Turmerol	8.94	0.97	Sesquiterpenic alcohol
trans-Sesquisabinene hydrate	1.67	0.18	Sesquiterpenic alcohol
Unknown	0.88	0.10	Oxygenated sesquiterpene
ar-Dihydroturmerone	1.45	0.16	Sesquiterpenic ketone
Unknown	6.62	0.72	Oxygenated sesquiterpene
Unknown	1.46	0.16	Oxygenated sesquiterpene
Unknown	3.99	0.43	Oxygenated sesquiterpene
cis-Zingiberenol	3.16	0.34	Sesquiterpenic alcohol
Unknown	4.17	0.45	Oxygenated sesquiterpene
Unknown	3.77	0.41	Oxygenated sesquiterpene
trans-Zingiberenol	9.87	1.07	Sesquiterpenic alcohol
Unknown	4.21	0.46	Oxygenated sesquiterpene
ar-Turmerone	267.53	29.10	Sesquiterpenic ketone
Unknown	23.60	2.57	Oxygenated sesquiterpene
α-Turmerone	113.03	12.30	Sesquiterpenic ketone
Unknown	0.68	0.07	Oxygenated sesquiterpene
Unknown	1.11	0.12	Unknown
Unknown	6.61	0.72	Oxygenated sesquiterpene
β-Turmerone	145.47	15.82	Sesquiterpenic ketone
(Z)-α-Atlantone	2.49	0.27	Sesquiterpenic ketone
Curcuphenol	0.21	0.02	Sesquiterpenic alcohol
(6S,7R)-Bisabolone	7.83	0.85	Sesquiterpenic ketone
Unknown	0.99	0.11	Oxygenated sesquiterpene
Unknown	5.27	0.57	Unknown
Xanthorizzhol?	1.27	0.14	Sesquiterpenic alcohol
Unknown	12.10	1.32	Oxygenated sesquiterpene
Unknown	18.50	2.01	Oxygenated sesquiterpene
(E)-α-Atlantone	11.21	1.22	Sesquiterpenic ketone
Unknown	6.72	0.73	Oxygenated sesquiterpene
Unknown	6.60	0.72	Oxygenated sesquiterpene
Unknown	1.37	0.15	Oxygenated sesquiterpene
Unknown	9.22	1.00	Oxygenated sesquiterpene
Unknown	6.63	0.72	Unknown
Unknown	1.82	0.20	Oxygenated sesquiterpene
Unknown	1.85	0.20	Oxygenated sesquiterpene
Unknown	1.11	0.12	Oxygenated sesquiterpene
Unknown	1.25	0.14	Oxygenated sesquiterpene
Unknown	0.35	0.04	Oxygenated sesquiterpene
Unknown	9.25	1.01	Oxygenated sesquiterpene
Unknown	5.08	0.55	Unknown
Unknown	1.38	0.15	Oxygenated sesquiterpene
Unknown	8.19	0.89	Oxygenated sesquiterpene

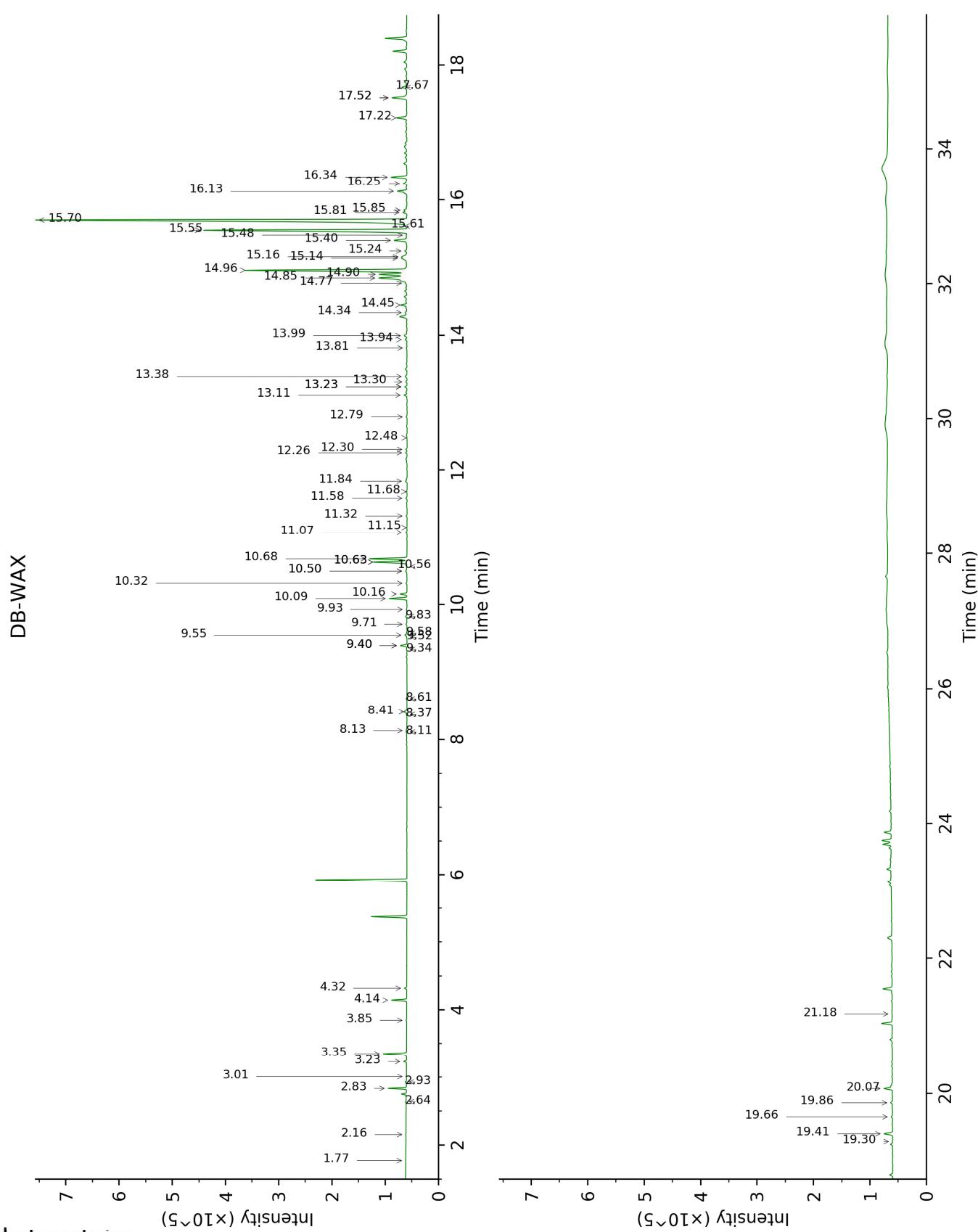
Unknown	0.50	0.05	Oxygenated sesquiterpene
Unknown	5.76	0.63	Oxygenated sesquiterpene
Unknown	1.38	0.15	Oxygenated sesquiterpene
Unknown	3.57	0.39	Oxygenated sesquiterpene
Consolidated total	857.25 mg/g	93.26%	

Individual compounds contents were corrected following the method of Cachet et al., 2016 (Flavour and Fragrance Journal guidelines).
Unknown compounds are expressed in equivalents of internal standard without correction.

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.





FULL ANALYSIS DATA

Identification	Column DB-5			Column DB-WAX		
	R.T	R.I	mg/g	R.T	R.I	mg/g
α-Pinene	3.01	932	0.78	1.45	998	0.68
Camphene	3.20	945	0.08	1.78	1031	0.07
β-Pinene	3.62	972	0.22	2.16	1069	0.20
Myrcene	3.93	993	0.59	2.93	1135	0.54
α-Phellandrene	4.06	1002	7.56	2.84	1127	7.54
Δ3-Carene	4.15	1007	0.34	2.64	1112	0.25
α-Terpinene	4.26	1014	0.26	3.01	1141	0.24
para-Cymene	4.38	1022	6.30	4.14	1227	6.44
Limonene	4.46*	1027	12.77	3.23	1158	1.28
1,8-Cineole	4.46*	1027	[14.51]	3.35	1168	12.96
γ-Terpinene	4.93	1056	0.36	3.85	1206	0.38
Terpinolene	5.38	1085	1.22	4.32	1240	1.12
Linalool	5.64	1101	0.50	8.13	1518	0.60
cis-para-Menth-2-en-1-ol	5.90	1118	0.22	8.11	1517	0.30
δ-Terpineol	6.62	1165	0.24	9.52	1627	0.31
Terpinen-4-ol	6.76	1174	0.68	8.61	1555	0.59
4-Methylacetophenone	6.85	1179	0.22	10.50*	1706	1.02
para-Cymen-8-ol	6.93	1185	0.75	11.58	1798	0.99
α-Terpineol	6.99	1189	1.06	9.83	1652	1.01
cis-α-Phellandrene epoxide (IPP vs Me)	7.15	1199	1.16	11.07	1755	0.95
Unknown [m/z 93, 43 (60), 108 (58), 69 (36), 41 (35)... 150 (5), 184 (1)]	8.55	1294	0.25	13.23*	1945	2.06
Thymol	8.70	1305	0.52	15.16†	2129	[8.83]
Carvacrol	8.82	1308	0.52	15.48	2160	0.48
para-Menth-5-en-1,2-diol isomer III	8.90	1314	1.26	15.24	2137	2.11
Unknown [m/z 119, 161 (36), 43 (33), 176 (26), 91 (24), 105 (22)]	9.74	1374	0.22	12.48	1876	0.27
Unknown [m/z 43, 105 (50), 120 (40), 145 (36), 119 (33), 93 (30)... 176 (6)]	9.91	1386	0.30	11.68	1807	0.65
Unknown [m/z 71, 100 (92), 111 (79), 69 (46), 109 (45) ...]	10.02	1394	1.18	17.22	2341	9.03
Unknown [m/z 119, 93 (83), 91 (51), 77 (32), 41 (31)... 202 (16)]	10.06	1397	0.43	8.37	1537	0.57
(Z?)-Vestitenone, or analog	10.14	1403	0.77	11.84	1820	1.15
β-Caryophyllene	10.24	1410	2.00	8.41	1540	1.86

Laboratoire
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(E)-Vestitenone	10.62*	1438	4.33	12.26	1857	1.07
Unknown [m/z 91, 129 (98), 143 (94), 185 (81), 200 (76)...]	10.62*	1438	[4.99]			
α-Humulene	10.71*	1445	1.38	9.34	1612	0.46
Unknown [m/z 69, 91 (78), 109 (54), 202 (43), 41 (36), 120 (34)]	10.71*	1445	[1.84]	9.40*	1617	4.99
(E)-β-Farnesene	10.85	1456	1.42	9.55	1629	1.17
β-Acoradiene	10.90	1460	0.30	9.40*	1617	[3.75]
γ-Curcumene	11.12	1476	0.87	9.71	1642	0.74
αr-Curcumene	11.16*	1479	18.56	10.68	1722	18.22
trans-β-Bergamotene	11.16*	1479	[19.72]	9.58	1632	0.39
Unknown [m/z 95, 119 (77), 91 (72), 105 (64), 202 (63), 93 (61), 145 (57), 131 (56)]	11.16*	1479	[26.25]	9.93	1660	0.74
α-Zingiberene	11.34	1493	9.29	10.09	1673	9.15
β-Bisabolene	11.51	1506	3.67	10.16	1678	3.76
β-Curcumene	11.55*	1509	1.07	10.32	1691	0.62
Unknown [m/z 93, 91 (62), 119 (57), 105 (44), 43 (43)... 220? (1)]	11.55*	1509	[1.42]			
Unknown [m/z 121, 93 (56), 91 (12), 94 (11), 122 (10)...220]	11.59	1512	0.24	13.38	1959	2.46
β-Sesquiphellandrene	11.70	1520	18.42	10.63*	1718	18.49
Unknown [m/z 91, 79 (97), 119 (91), 105 (75), 159 (65), 93 (61)...202(14)]	11.76	1525	2.07	11.32	1776	0.83
Selina-4(15),7(11)-diene	11.79	1528	0.66	10.56	1712	0.37
Selina-3,7(11)-diene	11.85	1533	0.56	10.63*	1718	[18.49]
Unknown [m/z 91, 93 (82), 79 (79), 77 (68), 67 (55), 41 (49)... 202 (12)]	12.04*	1548	1.27	10.50*	1706	[1.21]
Germacrene B	12.04*	1548	[0.95]	11.15	1761	0.24
cis-Sesquisabinene hydrate	12.09	1551	0.30	13.30	1952	0.94
Unknown [m/z 138, 96 (100), 95 (85), 109 (74), 110 (60), 105 (57)... 220 (10)]	12.16	1557	1.40	12.30	1861	1.12
Unknown [m/z 109, 67 (30), 43 (24), 91 (19)...]	12.23	1562	1.35			
(E)-Nerolidol	12.25	1564	1.13	13.81	1999	0.83

Unknown [m/z 105, 83 (65), 120 (41), 119 (35), 91 (29), 55 (22)... 218? (t)]	12.37*	1573	3.37	13.11	1934	2.27
Caryophyllene oxide	12.37*	1573	[2.79]	12.78	1904	0.69
ar-Turmerol	12.41	1577	8.94	15.40	2153	8.43
<i>trans</i> -Sesquisabinene hydrate	12.55*	1587	2.39	14.34	2049	1.67
Unknown [m/z 43, 91 (63), 41 (61), 79 (58), 95 (49), 93 (47)... 202 (36) ...]	12.55*	1587	[2.92]			
ar-Dihydroturmerone	12.57	1589	1.45	13.99	2016	2.33
Unknown [m/z 119, 132 (17), 91 (12), 120 (10), 117 (9)... 216? (2)]	12.70	1599	6.62	14.85	2098	31.58
Unknown [m/z 94, 79 (81), 91 (44), 43 (40), 125 (34), 77 (33), 93 (30)... 218 (11)]	12.72	1601	1.46	13.23*	1945	[2.06]
Unknown [m/z 43, 93 (88), 91 (76), 79 (73), 69 (64), 41 (63), 95 (53)... 220 (3)]	12.79	1606	3.99	17.52*	2373	13.63
<i>cis</i> -Zingiberenol	12.84	1610	3.16	14.45	2059	4.21
Unknown [m/z 119, 85 (92), 105 (37), 120 (36), 91 (28)... 218 (6)]	12.98	1622	4.17	16.24	2238	3.71
Unknown [m/z 120, 91 (29), 43 (25), 93 (23), 77 (21)... 218 (1)]	13.05	1628	3.77	13.94	2011	1.56
<i>trans</i> -Zingiberenol	13.10	1632	9.87	15.14†	2127	8.95
Unknown [m/z 83, 109 (45), 43 (43), 55 (36), 41 (35)... 220 (3)]	13.21	1641	4.21	15.85	2198	2.73
ar-Turmerone	13.50*	1665	272.79	15.70	2183	267.53
Unknown [m/z 105, 119 (63), 120 (45), 83 (44), 91 (16)... 218 (9)]	13.50*	1665	[345.33]	14.90	2103	23.60
α-Turmerone	13.53	1668	113.03	14.96	2109	107.32
Unknown [m/z 69, 41 (90), 123 (74), 122 (51)... 206 (14), 218 (2)]	13.69	1681	0.68	15.81	2194	3.18
Unknown [m/z 120, 85 (26), 125 (22), 91 (19), 105 (17), 121 (15) ...]	13.72	1683	1.11			
Unknown [m/z 199, 132 (99), 59 (25), 91	13.84	1693	6.61	17.67	2390	4.56

(20), 117 (19), 43 (14)... 216? (6)]						
β-Turmerone	13.90	1699	145.47	15.55	2168	140.54
(Z)-α-Atlantone	14.06	1712	2.49	15.61	2174	1.64
Curcuphenol	14.11	1716	0.21	19.30	2572	0.20
(6S,7R)-Bisabolone	14.39	1741	7.83	16.13	2227	6.00
Unknown [m/z 120, 91 (22), 59 (20), 121 (19), 105 (15)... 218 (1)]	14.43	1744	0.99	14.77	2090	1.13
Unknown [m/z 83, 105 (81), 93 (74), 120 (71), 109 (65), 91 (58) ...]	14.48*	1749	6.90			
Xanthorizzhol?	14.48*	1749	[5.38]	19.86	2639	1.27
Unknown [m/z 83, 55 (21), 43 (13), 41 (9), 91 (8)... 234? (1)]	14.58	1757	12.10	17.52*	2373	[13.63]
Unknown [m/z 119, 83 (30), 91 (14), 120 (11), 114 (9)... 234 (1)]	14.63	1761	18.50			
(E)-α-Atlantone	14.72	1770	11.21	16.34	2248	10.29
Unknown [m/z 95, 136 (77), 83 (68), 125 (55), 109 (40), 110 (39)... 234 (7)]	14.91	1786	6.72	19.41	2586	7.22
Unknown [m/z 83, 120 (39), 121 (38), 119 (30), 123 (29), 55 (19)... 218 (5)]	15.02	1795	6.60			
Unknown [m/z 83, 93 (61), 55 (24), 94 (24), 43 (22), 91 (19)... 234? (1)]	15.07	1800	1.37			
Unknown [m/z 69, 43 (95), 41 (84), 109 (78), 95 (54), 93 (49)... 177 (36), 220 (2) ...]	15.12*	1804	15.85	20.07	2664	9.22
Unknown [m/z 83, 121 (74), 114 (74), 93 (40), 55 (20), 91 (20) ...]	15.12*	1804	[15.85]			
Unknown [m/z 83, 119 (56), 95 (53), 234 (32), 91 (30)]	15.22	1813	1.82	19.66	2615	1.38
Unknown [m/z 83, 136 (51), 43 (46), 109 (29), 55 (26), 119 (22)... 234 (1)]	15.41	1830	1.85			
Unknown [m/z 83, 136 (36), 55 (26), 109	15.44	1834	1.11			

(21), 79 (17), 43 (16)... 232 (11)]						
Unknown [m/z 83, 107 (37), 43 (32), 135 (30), 55 (27)...]	15.68	1855	1.25			
Unknown [m/z 118, 83 (68), 55 (25), 117 (20), 43 (16)... 232 (1)]	15.76	1862	0.35	21.18	2799	0.43
Unknown [m/z 83, 43 (24), 55 (21), 109 (15), 135 (14)... 232 (1)]	15.91	1876	9.25			
Unknown [m/z 118, 83 (89), 135 (58), 117 (20), 55 (19), 136 (18)...]	15.93	1877	5.08			
Unknown [m/z 83, 55 (15), 43 (14), 91 (8)... 232 (1)]	16.37	1918	1.38			
Unknown [m/z 83, 149 (24), 135 (24), 55 (24), 43 (13)... 232 (3)]	16.57	1937	8.19			
Unknown [m/z 83, 55 (18), 43 (14), 84 (6)... 232 (t)]	16.68	1948	0.50			
Unknown [m/z 83, 55 (22), 43 (22), 119 (19), 41 (10)...]	17.03	1980	5.76			
Unknown [m/z 83, 43 (22), 55 (20), 98 (14), 119 (14)...]	17.10	1987	1.38			
Unknown [m/z 83, 55 (18), 43 (16), 98 (11)...]	18.58	2134	3.57			

*: Two or more compounds are coeluting on this column

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

t: Peaks apexes were resolved, but peaks overlapped and were summed for analysis

Individual compounds contents were corrected following the method of Cachet et al., 2016 (Flavour and Fragrance Journal guidelines).

Unknown compounds are expressed in equivalents of internal standard without correction.

R.T.: Retention time (minutes)

R.I.: Retention index