Date : January 21, 2020

Certificate of Analysis – GC Profiling

Sample identification

Internal code : 20A17-PTH02
Customer identification : Turmeric CO2 ORGANIC - India - TK010885R
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 factor[1]. Analysis with 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 : Sylvain Mercier, M. Sc., Chimiste
Analysis date : January 20, 2020

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Notes: This report may not be published, including online, without the written consent from Laboratoire PhytoChemia.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

Reference

(1) Cachet, T.; Brevard, H.; Chaintreau, A.; Demyttenaere, J.; French, L.; Gassenmeier, K.; Joulain, D.; Koenig, T.; Leijs, 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.*

Laboratoire PhytoChemia
628 Boulevard du Saguenay Ouest, Saguenay (Qc) G7J 1H4 | www.phytochemia.com

PHYSICOCHEMICAL DATA

Physical aspect: Bright yellow liquid
Refractive index: 1.5108 ± 0.0003 (20 °C)

CONCLUSION

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

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ANALYSIS SUMMARY

Identification	(mg/g)	% of total volatiles	Classe
α-Thujene	0.12	0.01	Monoterpene
α-Pinene	0.58	0.07	Monoterpene
β-Pinene	0.07	0.01	Monoterpene
Sabinene	0.04	tr	Monoterpene
Myrcene	0.54	0.06	Monoterpene
α-Phellandrene	8.25	0.95	Monoterpene
Δ3-Carene	0.18	0.02	Monoterpene
α-Terpinene	0.13	0.02	Monoterpene
para-Cymene	3.89	0.45	Monoterpene
β-Phellandrene	0.61	0.07	Monoterpene
Limonene	0.97	0.11	Monoterpene
1,8-Cineole	9.63	1.10	Monoterpenic ether
(*E*)-β-Ocimene	0.17	0.02	Monoterpene
γ-Terpinene	0.33	0.04	Monoterpene
Terpinolene	0.62	0.07	Monoterpene
Linalool	0.16	0.02	Monoterpenic alcohol
Terpinen-4-ol	0.32	0.04	Monoterpenic alcohol
para-Cymen-8-ol	0.17	0.02	Monoterpenic alcohol
α-Terpineol	0.57	0.07	Monoterpenic alcohol
α-Phellandrene epoxide	0.50	0.06	Monoterpenic ether
Thymol	0.15	0.02	Monoterpenic alcohol
Carvacrol	0.18	0.02	Monoterpenic alcohol
Unknown	0.53	0.06	Unknown
Unknown	0.18	0.02	Terpene derivative
Unknown	0.32	0.04	Terpene derivative
Unknown	0.79	0.09	Terpene derivative
Unknown	0.72	0.08	Unknown
Acora-3,7(14)-diene	0.23	0.03	Sesquiterpene
Unknown	0.58	0.07	Sesquiterpene
(*trans*?)-6-Hydroxypiperitone	2.36	0.27	Monoterpenic alcohol
β-Caryophyllene	4.11	0.47	Sesquiterpene
α-Santalene	9.69	1.11	Sesquiterpene
Caryophylla-4(12),8(13)-diene	0.31	0.04	Sesquiterpene
γ-Elemene	2.44	0.28	Sesquiterpene
trans-α-Bergamotene	1.37	0.16	Sesquiterpene
Unknown	1.33	0.15	Unknown
(*E*)-Vestitenone	1.69	0.19	Terpenic ketone
α-Humulene	1.79	0.21	Sesquiterpene
Unknown	0.72	0.08	Sesquiterpene
β-Acoradiene	2.25	0.26	Sesquiterpene
(*E*)-β-Farnesene	3.69	0.42	Sesquiterpene
γ-Curcumene	1.35	0.16	Sesquiterpene
ar-Curcumene	21.66	2.48	Sesquiterpene
trans-β-Bergamotene	0.61	0.07	Sesquiterpene
Unknown	1.15	0.13	Sesquiterpene
α-Zingiberene	38.24	4.38	Sesquiterpene
Unknown	1.36	0.16	Sesquiterpene

β-Bisabolene	10.19	1.17	Sesquiterpene
Unknown	0.66	0.08	Oxygenated sesquiterpene
β-Curcumene	0.19	0.02	Sesquiterpene
Unknown	16.95	1.94	Oxygenated sesquiterpene
β-Sesquiphellandrene	47.89	5.49	Sesquiterpene
Selina-4(15),7(11)-diene	2.02	0.23	Sesquiterpene
(*E*)-γ-Bisabolene	3.20	0.37	Sesquiterpene
Selina-3,7(11)-diene	1.52	0.17	Sesquiterpene
Unknown	0.28	0.03	Sesquiterpene
Germacrene B	7.48	0.86	Sesquiterpene
cis-Sesquisabinene hydrate	0.92	0.10	Sesquiterpenic alcohol
Unknown	2.22	0.25	Oxygenated sesquiterpene
(*E*)-Nerolidol	0.44	0.05	Sesquiterpenic alcohol
Unknown	2.89	0.33	Unknown
Caryophyllene oxide	1.10	0.13	Sesquiterpenic ether
Caryophyllene oxide isomer	0.20	0.02	Sesquiterpenic ether
ar-Turmerol	4.56	0.52	Sesquiterpenic alcohol
Unknown	8.98	1.03	Oxygenated sesquiterpene
trans-Sesquisabinene hydrate	3.13	0.36	Sesquiterpenic alcohol
Unknown	6.29	0.72	Oxygenated sesquiterpene
ar-Dihydroturmerone	1.53	0.17	Sesquiterpenic ketone
Unknown	5.03	0.58	Oxygenated sesquiterpene
Unknown	2.85	0.33	Oxygenated sesquiterpene
cis-Zingiberenol	7.37	0.85	Sesquiterpenic alcohol
Unknown	13.59	1.56	Oxygenated sesquiterpene
trans-Zingiberenol	6.83	0.78	Sesquiterpenic alcohol
Unknown	6.26	0.72	Oxygenated sesquiterpene
Unknown	5.25	0.60	Oxygenated sesquiterpene
ar-Turmerone	172.70	19.80	Sesquiterpenic ketone
α-Turmerone	146.88	16.84	Sesquiterpenic ketone
Unknown	1.49	0.17	Oxygenated sesquiterpene
Unknown	10.54	1.21	Oxygenated sesquiterpene
Unknown	0.96	0.11	Oxygenated sesquiterpene
β-Turmerone	104.65	12.00	Sesquiterpenic ketone
(*Z*)-α-Atlantone	3.59	0.41	Sesquiterpenic ketone
Curcuphenol	1.67	0.19	Sesquiterpenic alcohol
(6S,7R)-Bisabolone	9.02	1.03	Sesquiterpenic ketone
Unknown	2.34	0.27	Oxygenated sesquiterpene
Xanthorizzhol?	0.31	0.04	Sesquiterpenic alcohol
Unknown	2.53	0.29	Unknown
Unknown	8.07	0.92	Oxygenated sesquiterpene
Unknown	4.78	0.55	Oxygenated sesquiterpene
(*E*)-α-Atlantone	16.82	1.93	Sesquiterpenic ketone
Unknown	3.71	0.42	Oxygenated sesquiterpene
Unknown	3.37	0.39	Oxygenated sesquiterpene
Unknown	4.27	0.49	Oxygenated sesquiterpene
Unknown	4.01	0.46	Unknown
Unknown	1.53	0.17	Oxygenated sesquiterpene
Unknown	0.86	0.10	Oxygenated sesquiterpene
Unknown	1.18	0.14	Oxygenated sesquiterpene
Unknown	0.66	0.08	Oxygenated sesquiterpene
Unknown	1.84	0.21	Oxygenated sesquiterpene

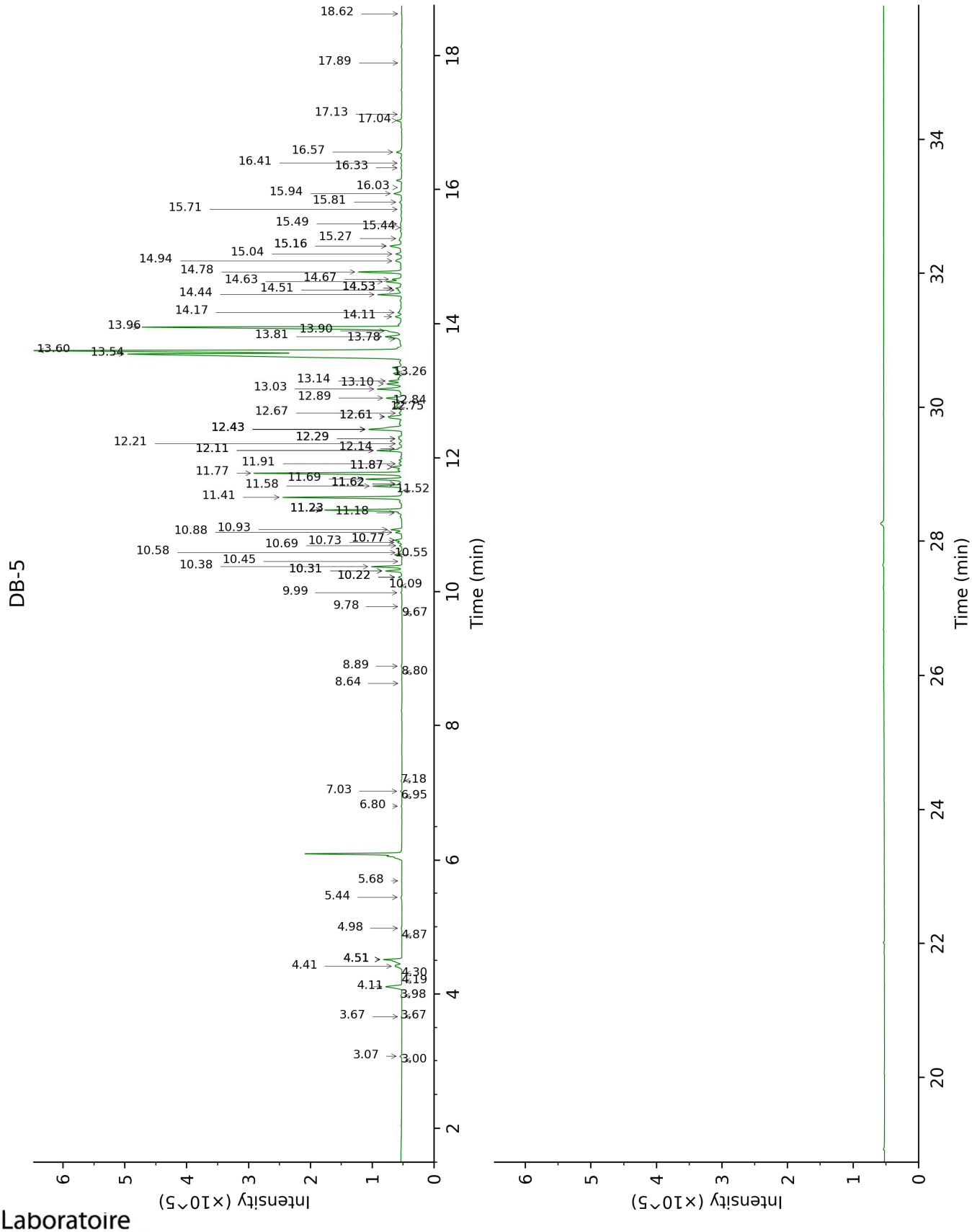
Unknown	5.12	0.59	Oxygenated sesquiterpene
Unknown	0.47	0.05	Unknown
Unknown	0.82	0.09	Oxygenated sesquiterpene
Unknown	0.72	0.08	Oxygenated sesquiterpene
Unknown	2.81	0.32	Oxygenated sesquiterpene
Unknown	2.54	0.29	Oxygenated sesquiterpene
Unknown	0.36	0.04	Oxygenated sesquiterpene
Unknown	0.28	0.03	Oxygenated sesquiterpene
Unknown	0.31	0.04	Oxygenated sesquiterpene
Consolidated total	**818.69 mg/g**	**93.88%**	

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

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.


DB-5
Intensity (×10^5)
Time (min)
18.62
17.89
17.13
17.04
16.57
16.41
16.33
16.03
15.94
15.81
15.71
15.49
15.44
15.27
15.16
15.04
14.94
14.78
14.67
14.63
14.53
14.51
14.44
14.17
14.11
13.96
13.90
13.81
13.78
13.60
13.54
13.26
13.14
13.10
13.03
12.89
12.84
12.75
12.67
12.61
12.43
12.29
12.21
12.14
12.11
11.91
11.87
11.77
11.69
11.62
11.58
11.52
11.41
11.23
11.18
10.93
10.88
10.77
10.73
10.69
10.58
10.55
10.45
10.38
10.31
10.22
10.09
9.99
9.78
9.67
8.89
8.80
8.64
7.18
7.03
6.95
6.80
5.68
5.44
4.98
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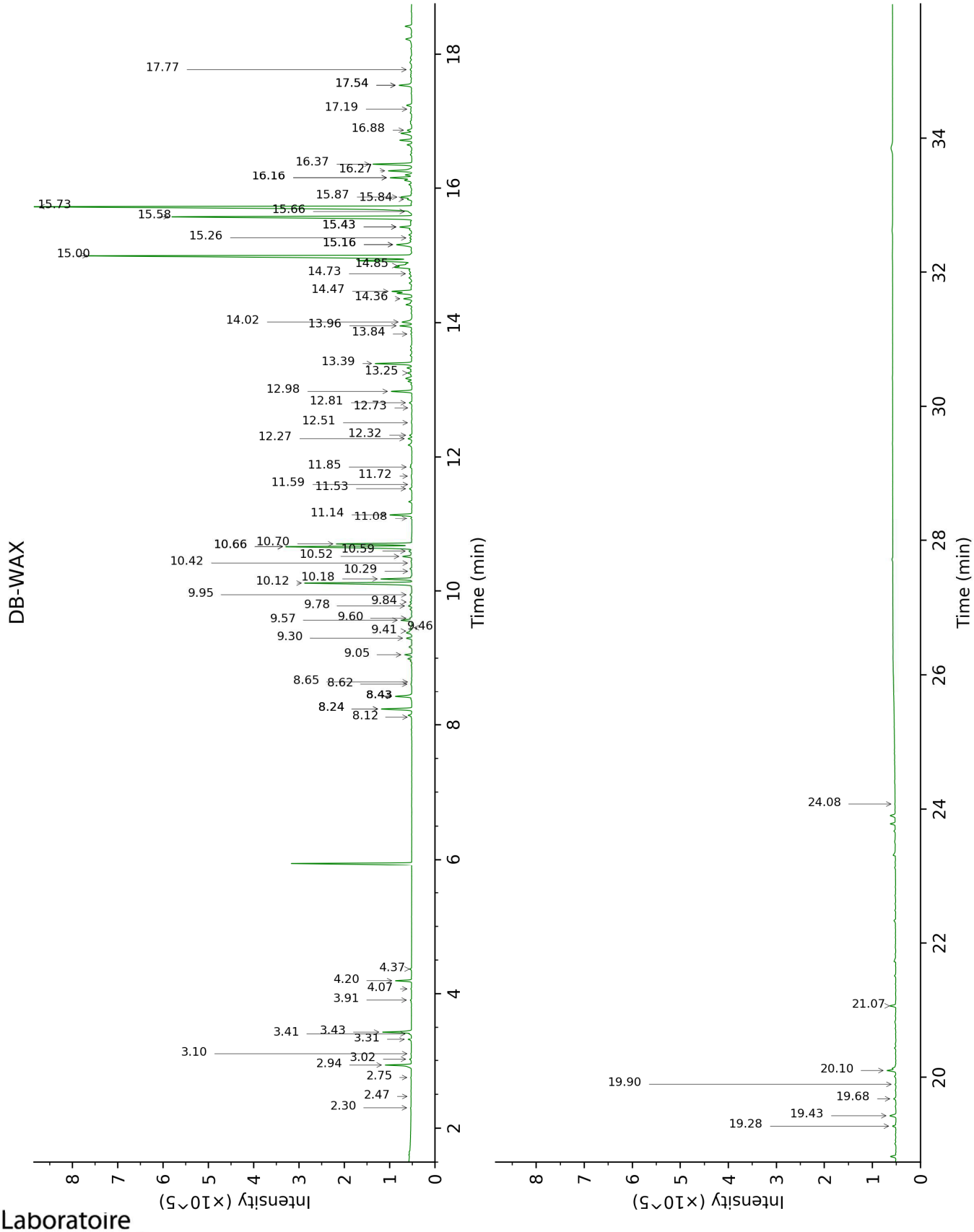
4.11
3.98
3.67
3.67
3.07
3.00


DB-WAX
Intensity (×10^5)
Time (min)
17.77
17.54
17.19
16.88
16.37
16.27
16.16
15.87
15.84
15.73
15.66
15.58
15.43
15.26
15.16
15.00
14.85
14.73
14.47
14.36
14.02
13.96
13.84
13.39
13.25
12.98
12.81
12.73
12.51
12.27
12.32
11.85
11.72
11.59
11.53
11.14
11.08
10.66
10.70
10.52
10.59
10.42
10.29
10.12
10.18
9.95
9.78
9.84
9.57
9.60
9.41
9.46
9.30
9.05
8.65
8.62
8.43
8.24
8.12
4.37
4.20
4.07
3.91
3.41
3.43
3.31
3.10
3.02
2.94
2.75
2.47
2.30
24.08
21.07
20.10
19.90
19.68
19.43
19.28

FULL ANALYSIS DATA

Identification	Column DB-5			Column DB-WAX		
	R.T	R.I	mg/g	R.T	R.I	mg/g
α-Thujene	3.00	928	0.12			
α-Pinene	3.07	932	0.58			
β-Pinene	3.66*	972	0.30	2.30	1086	0.07
Sabinene	3.66*	972	[0.30]	2.47	1102	0.04
Myrcene	3.98	992	0.54	3.02	1144	0.53
α-Phellandrene	4.11	1001	8.25	2.94	1138	8.20
Δ3-Carene	4.19	1007	0.18	2.75	1123	0.15
α-Terpinene	4.30	1014	0.13	3.10	1150	0.16
para-Cymene	4.41	1021	3.89	4.20	1233	4.00
β-Phellandrene	4.51*	1027	9.13	3.41	1174	0.61
Limonene	4.51*	1027	[9.13]	3.31	1167	0.97
1,8-Cineole	4.51*	1027	[10.37]	3.43	1176	9.63
(*E*)-β-Ocimene	4.86	1049	0.17	4.07	1224	0.24
γ-Terpinene	4.98	1056	0.33	3.91	1212	0.35
Terpinolene	5.44	1086	0.62	4.37	1245	0.61
Linalool	5.68	1101	0.16	8.12	1519	0.21
Terpinen-4-ol	6.80	1174	0.32	8.62	1558	0.45
para-Cymen-8-ol	6.95	1184	0.17	11.59	1802	0.13
α-Terpineol	7.02	1189	0.57	9.84	1655	0.71
α-Phellandrene epoxide	7.18	1199	0.50	11.08	1758	0.47
Thymol	8.64	1300	0.15	15.16*	2133	8.46
Carvacrol	8.80	1305	0.18	15.43*	2159	4.90
Unknown [m/z 111, 126 (93), 43 (90), 71 (60)...]	8.90	1312	0.53	15.26	2143	1.09
Unknown [m/z 105, 91 (66), 120 (53), 93 (48), 77 (47), 71 (46), 43 (37), 145 (22)... 178 (2)]	9.67	1367	0.18	11.53	1796	1.23
Unknown [m/z 119, 161 (36), 43 (33), 176 (26), 91 (24), 105 (22)]	9.78	1375	0.32	12.51	1882	0.32
Unknown [m/z 43, 105 (50), 120 (40), 145 (36), 119 (33), 93 (30)... 176 (6)]	9.99	1389	0.79	11.72	1812	0.73
Unknown [m/z 71, 100 (92), 111 (79), 69 (46), 109 (45)...]	10.09	1396	0.72	17.19	2342	0.65
Acora-3,7(14)-diene	10.22*	1406	1.45	8.24*	1529	9.92
Unknown [m/z 119, 93 (83), 91 (51), 77 (32), 41 (31)... 202 (16)]	10.22*	1406	[1.93]	8.43*	1543	7.89
(*trans*?)-6-	10.31*	1413	7.94	16.88	2308	2.36

Hydroxypiperitone						
β-Caryophyllene	10.31*	1413	[5.85]	8.43*	1543	[5.92]
α-Santalene	10.38	1417	9.69	8.24*	1529	[9.92]
Caryophylla-4(12),8(13)-diene	10.45	1423	0.31	8.65	1560	0.15
γ-Elemene	10.55	1431	2.44	9.06	1592	2.23
trans-α-Bergamotene	10.58	1433	1.37	8.43*	1543	[5.92]
Unknown [m/z 91, 129 (98), 143 (94), 185 (81), 200 (76)...]	10.69	1441	1.33			
(*E*)-Vestitenone	10.74	1444	1.69	12.27	1861	1.52
α-Humulene	10.77*	1447	2.57	9.30	1611	1.79
Unknown [m/z 69, 91 (78), 109 (54), 202 (43), 41 (36), 120 (34)]	10.77*	1447	[3.42]	9.41	1620	0.72
β-Acoradiene	10.88	1455	2.25	9.46	1624	0.55
(*E*)-β-Farnesene	10.93	1459	3.69	9.57	1633	3.38
γ-Curcumene	11.18	1478	1.35	9.78	1650	1.24
ar-Curcumene	11.23*	1481	22.77	10.70	1726	21.66
trans-β-Bergamotene	11.23*	1481	[24.20]	9.60	1635	0.61
Unknown [m/z 95, 119 (77), 91 (72), 105 (64), 202 (63), 93 (61), 145 (57), 131 (56)]	11.23*	1481	[32.22]	9.95	1664	1.15
α-Zingiberene	11.42	1495	38.24	10.12	1678	37.39
Unknown [m/z 119, 91 (14), 120 (10), 117 (9)... 200? (2)]	11.52	1502	1.36	11.85	1824	0.85
β-Bisabolene	11.58	1508	10.19	10.18	1682	9.51
Unknown [m/z 93, 91 (62), 119 (57), 105 (44), 43 (43)... 220? (1)]	11.62*	1510	0.92			
β-Curcumene	11.62*	1510	[0.69]	10.29	1692	0.19
Unknown [m/z 121, 93 (56), 91 (12), 94 (11), 122 (10)...220]	11.69	1516	16.95	13.39	1963	16.33
β-Sesquiphellandrene	11.77	1523	47.89	10.66*	1722	47.11
Selina-4(15),7(11)-diene	11.87*†	1530	5.23	10.66*	1722	[47.11]
(*E*)-γ-Bisabolene	11.87*†	1530	[5.23]	10.52	1710	3.20
Selina-3,7(11)-diene	11.91	1534	1.52	10.59	1717	1.24
Unknown [m/z 91, 93 (82), 79 (79), 77 (68), 67 (55), 41 (49)... 202 (12)]	12.11*	1549	11.31	10.42	1702	0.28
Germacrene B	12.11*	1549	[8.49]	11.14	1763	7.48

cis-Sesquisabinene hydrate	12.14	1552	0.92	13.25	1950	1.75
Unknown [m/z 138, 96 (100), 95 (85), 109 (74), 110 (60), 105 (57)... 220 (10)]	12.21	1557	2.22	12.32	1866	1.04
(*E*)-Nerolidol	12.28*†	1563	2.80	13.84	2004	0.44
Unknown [m/z 109, 67 (30), 43 (24), 91 (19)...]	12.28*†	1563	[3.42]			
Caryophyllene oxide	12.43*†	1574	19.86	12.81	1909	1.10
Caryophyllene oxide isomer	12.43*†	1574	[19.86]	12.73	1902	0.20
ar-Turmerol	12.43*†	1574	[18.69]	15.43*	2159	[4.73]
Unknown [m/z 105, 83 (65), 120 (41), 119 (35), 91 (29), 55 (22)... 218? (t)]	12.43*†	1574	[23.94]	12.98	1924	8.98
trans-Sesquisabinene hydrate	12.61*	1589	8.28	14.36	2054	3.13
Unknown [m/z 43, 91 (63), 41 (61), 79 (58), 95 (49), 93 (47)... 202 (36)...]	12.61*	1589	[10.11]			
ar-Dihydroturmerone	12.67	1593	1.53	13.96	2016	4.15
Unknown [m/z 119, 132 (17), 91 (12), 120 (10), 117 (9)... 216? (2)]	12.75	1599	5.03	14.85	2102	15.28
Unknown [m/z 43, 93 (88), 91 (76), 79 (73), 69 (64), 41 (63), 95 (53).. 220 (3)]	12.84	1606	2.85	17.54*	2380	7.00
cis-Zingiberenol	12.89	1611	7.37	14.47	2065	7.36
Unknown [m/z 119, 85 (92), 105 (37), 120 (36), 91 (28)... 218 (6)]	13.02	1622	13.59	16.27	2245	11.76
trans-Zingiberenol	13.10	1628	6.83	15.16*	2133	[8.58]
Unknown [m/z 120, 91 (29), 43 (25), 93 (23), 77 (21)... 218 (1)]	13.14	1632	6.26	14.02	2021	6.03
Unknown [m/z 83, 109 (45), 43 (43), 55 (36), 41 (35)... 220 (3)]	13.26	1641	5.25	15.87†	2204	[7.97]
ar-Turmerone	13.54†	1665	350.50	15.73	2189	172.70
α-Turmerone	13.60†	1669	[373.13]	15.00	2116	146.88

Unknown [m/z 69, 41 (90), 123 (74), 122 (51)... 206 (14), 218 (2)]	13.78	1684	1.49	15.84†	2200	7.97
Unknown [m/z 137, 119 (70), 84 (69), 41 (68), 69 (53), 55 (45), 109 (38)... 222 (2)]	13.81	1687	10.54	16.16*†	2233	13.75
Unknown [m/z 199, 132 (99), 59 (25), 91 (20), 117 (19), 43 (14)... 216? (6)]	13.90†	1694	143.82	17.77	2405	0.96
β-Turmerone	13.96†	1699	[120.94]	15.58	2174	104.65
(*Z*)-α-Atlantone	14.11	1712	3.59	15.66	2182	1.23
Curcuphenol	14.17	1717	1.67	19.28	2576	1.15
(6S,7R)-Bisabolone	14.44	1740	9.02	16.16*†	2233	[11.41]
Unknown [m/z 120, 91 (22), 59 (20), 121 (19), 105 (15)... 218 (1)]	14.51	1746	2.34	14.73	2090	1.66
Xanthorizzhol?	14.53*	1748	2.29	19.90	2648	0.31
Unknown [m/z 83, 105 (81), 93 (74), 120 (71), 109 (65), 91 (58)...]	14.53*	1748	[2.93]			
Unknown [m/z 83, 55 (21), 43 (13), 41 (9), 91 (8)... 234? (1)]	14.63	1757	8.07	17.54*	2380	[7.00]
Unknown [m/z 119, 83 (30), 91 (14), 120 (11), 114 (9)... 234 (1)]	14.67	1760	4.78			
(*E*)-α-Atlantone	14.78	1769	16.82	16.37	2255	14.62
Unknown [m/z 95, 136 (77), 83 (68), 125 (55), 109 (40), 110 (39)... 234 (7)]	14.94	1784	3.71	19.44	2593	3.37
Unknown [m/z 83, 93 (61), 55 (24), 94 (24), 43 (22), 91 (19)... 234? (1)]	15.04	1792	3.37			
Unknown [m/z 69, 43 (95), 41 (84), 109 (78), 95 (54), 93 (49)... 177 (36), 220 (2)...]	15.16*	1803	8.28	20.10	2673	4.27
Unknown [m/z 83, 121 (74), 114 (74), 93 (40), 55 (20), 91 (20)...]	15.16*	1803	[8.28]			
Unknown [m/z 83, 119 (56), 95 (53),	15.27	1813	1.53	19.68	2623	1.20

234 (32), 91 (30)]						
Unknown [m/z 83, 136 (51), 43 (46), 109 (29), 55 (26), 119 (22)...234 (1)]	15.44	1827	0.86			
Unknown [m/z 83, 136 (36), 55 (26), 109 (21), 79 (17), 43 (16)... 232 (11)]	15.49	1832	1.18			
Unknown [m/z 83, 107 (37), 43 (32), 135 (30), 55 (27)...]	15.71	1852	0.66			
Unknown [m/z 118, 83 (68), 55 (25), 117 (20), 43 (16)... 232 (1)]	15.81	1862	1.84	21.07	2791	2.91
Unknown [m/z 83, 43 (24), 55 (21), 109 (15), 135 (14)... 232 (1)]	15.94	1873	5.12			
Unknown [m/z 118, 83 (89), 135 (58), 117 (20), 55 (19), 136 (18)...]	16.03	1882	0.47			
Unknown [m/z 83, 43 (14), 55 (14), 92 (7), 91 (7)... 232 (1)]	16.33	1909	0.82			
Unknown [m/z 83, 55 (15), 43 (14), 91 (8)... 232 (1)]	16.40	1916	0.72			
Unknown [m/z 83, 149 (24), 135 (24), 55 (24), 43 (13)... 232 (3)]	16.57	1931	2.81			
Unknown [m/z 83, 55 (22), 43 (22), 119 (19), 41 (10)...]	17.04	1976	2.54			
Unknown [m/z 83, 43 (22), 55 (20), 98 (14), 119 (14)...]	17.13	1984	0.36	24.08	3190	0.16
Unknown [m/z 83, 135 (32), 55 (26), 125 (18), 41 (13), 109 (12)... 248 (1)]	17.89	2059	0.28			
Unknown [m/z 83, 55 (18), 43 (16), 98 (11)...]	18.62	2132	0.31			

*: 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.

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

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