Date : March 20, 2016

SAMPLE IDENTIFICATION

Internal code : 16C09-CRH2-1-HM
Customer identification : Young Living - Cinnamon Bark - Lot #14120235 - Untampered seal
Type : Essential oil
Source : *Cinnamomum verum*
Customer : Crystal Heck

ANALYSIS

Method : PC-PA-001-15E06, "Analysis of the composition of a liquid essential oil by GC-FID" (in French). Identifications double-checked by GC-MS
Analyst : Alexis St-Gelais, M. Sc., chimiste
Analysis date : 2016-03-19

Checked and approved by :

Alexis St-Gelais, M. Sc., chimiste 2013-174

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IDENTIFIED COMPOUNDS

Identification	Column: BP5			Column: WAX			Molecular Class
	R.T.	R.I.	%	%	R.I.	R.T.	
Hexanal	1.57	803	tr	tr	1020	1.26	Aliphatic aldehyde
Furfural	2.07	844	0.01	0.01	1411	6.01*	Furan
cis-Hex-3-en-1-ol	2.35	866	0.01	tr	1343	5.01*	Aliphatic alcohol
Styrene	2.63	890	0.07	0.06	1194	2.97	Phenylpropanoid
α-Thujene	3.07	920	0.01	0.01	958	0.94	Monoterpene
α-Pinene	3.17	926	0.07	0.07	949	0.90	Monoterpene
Camphene	3.44	943	0.05	0.04	1004	1.13	Monoterpene
Benzaldehyde	3.88*	969	0.60	0.48	1442	6.59	Simple phenolic
β-Pinene	3.88*	969	[0.60]	0.02	1042	1.43	Monoterpene
Sabinene	3.88*	969	[0.60]	tr	1060	1.57	Monoterpene
Myrcene	4.20	989	0.01	0.01	1118	2.07	Monoterpene
6-Methyl-5-hepten-2-one	4.32	996	0.01	0.01	1284	4.17	Aliphatic ketone
α-Phellandrene	4.46*	1005	0.03	0.03	1110	1.99	Monoterpene
Δ3-Carene	4.46*	1005	[0.03]	tr	1093	1.83	Monoterpene
α-Terpinene	4.65	1015	0.03	0.03	1124	2.14	Monoterpene
meta-Cymene	4.74	1020	0.01				Monoterpene
para-Cymene	4.82	1025	1.66	1.69	1213	3.20	Monoterpene
Limonene	4.87	1028	0.54	0.53	1142	2.35	Monoterpene
β-Phellandrene	4.89	1029	0.09	0.11	1148	2.42*	Monoterpene
1,8-Cineole	4.95	1032	0.03	[0.11]	1148	2.42*	Monoterp. ether
cis-β-Ocimene	5.05	1038	0.01	0.01	1191	2.92*	Monoterpene
trans-β-Ocimene	5.23	1048	tr	tr	1207	3.10	Monoterpene
Salicylaldehyde	5.31	1053	0.13	0.12	1585	10.11*	Simple phenolic
γ-Terpinene	5.41	1058	tr	[0.01]	1191	2.92*	Monoterpene
cis-Linalool oxide (fur.)	5.70	1074	0.01	0.01	1389	5.68	Monoterp. alcohol
Acetophenone	5.75	1077	0.03	0.02	1558	9.30	Simple phenolic
Terpinolene	5.88	1084	0.01	0.01	1226	3.37	Monoterpene
trans-Linalool oxide (fur.)	6.00	1091	0.02	0.02	1415	6.09	Monoterp. alcohol
para-Cymenene	6.05*	1094	0.03	0.01	1374	5.48	Monoterpene
ortho-Guaiacol	6.05*	1094	[0.03]				Simple phenolic
Linalool	6.30†	1106	4.05	4.21	1508	7.85*	Monoterp. alcohol
Nonanal	6.35†	1108	[4.05]	[0.00]	1343	5.01*	Aliphatic aldehyde
Hydratropaldehyde?	6.42	1111	0.01	0.07	1560	9.38*	Phenylpropanoid
Phenylethyl alcohol	6.63	1119	0.44	0.48	1822	21.80	Simple phenolic
3-Methyl-2,3-dihydrobenzofuran	6.99	1134	0.02				Phenylpropanoid
trans-Pinocarveol	7.09	1137	tr	0.01	1577	9.86	Monoterp. alcohol
2-Methylbenzofuran	7.14	1139	0.01				Phenylpropanoid
Camphor	7.28	1145	0.01	0.01	1430	6.35	Monoterp. ketone
Hydrocinnamaldehyde	7.84	1167	0.33				Phenylpropanoid
Borneol	7.93	1170	0.08	0.08	1628	11.57	Monoterp. alcohol

3-Methylbenzofuran	7.99	1173	0.05				Phenylpropanoid
Terpinen-4-ol	8.14	1179	0.05	0.06	1536	8.64	Monoterp. alcohol
para-Cymen-8-ol	8.54	1195	0.01	0.02	1773	18.88	Monoterp. alcohol
α-Terpineol	8.69*	1201	0.09	0.11	1633	11.81	Monoterp. alcohol
Methylchavicol	8.69*	1201	[0.09]	0.01	1598	10.51	Phenylpropanoid
α-Phellandrene epoxide	8.93	1207	0.01	0.08	1729	16.25*	Monoterpene
Decanal	9.05	1209	tr	0.01	1437	6.49	Aliphatic aldehyde
(*Z*)-Cinnamaldehyde	9.65	1224	0.27	0.23	1780	19.30	Phenylpropanoid
Hydrocinnamyl alcohol	10.21	1237	0.05	0.07	1960	31.11	Phenylpropanoid
o-Anisaldehyde	10.41	1242	0.35	0.42	1842	23.13	Simple phenolic
Linalyl acetate	10.59	1246	0.02	0.03	1516	8.03	Monoterp. ester
Phenylethyl acetate	11.04	1256	0.07	[0.08]	1729	16.25*	Phenolic ester
(*E*)-Cinnamaldehyde	12.65	1294	67.57	67.64	1927	29.10	Phenylpropanoid
(*E*)-Cinnamyl alcohol	13.90	1317	0.12	0.20	2185	40.20	Phenylpropanoid
α-Cubebene	14.90	1334	0.01	[0.01]	1411	6.01*	Sesquiterpene
Eugenol	16.20	1355	3.95	4.07	2073	36.71	Phenylpropanoid
α-Copaene	16.49	1359	0.23	0.22	1433	6.42	Sesquiterpene
β-Bourbonene	16.88	1365	tr	tr	1452	6.79	Sesquiterpene
β-Elemene	17.35*	1373	0.18	0.06	1529	8.40	Sesquiterpene
Unknown (m/z = 91, 121 (75), 108 (64), 164 (43))	17.35*	1373	[0.18]				Phenylpropanoid
Isocaryophyllene	18.22	1387	0.02	[4.21]	1508	7.85*	Sesquiterpene
β-Caryophyllene	19.25	1403	4.14	4.15	1526	8.31	Sesquiterpene
Aromadendrene	20.04	1413	0.01	0.03	1531	8.47*	Sesquiterpene
trans-α-Bergamotene	20.46	1418	0.01	[0.03]	1531	8.47*	Sesquiterpene
Coumarine	21.72*	1433	1.50	1.31	2284	42.64	Coumarin
α-Humulene	21.72*	1433	[1.50]	[0.12]	1585	10.11*	Sesquiterpene
allo-Aromadendrene	22.04	1437	0.05	[0.07]	1560	9.38*	Sesquiterpene
(*E*)-Cinnamyl acetate	23.19	1451	2.38	2.30	2049	35.88	Phenylpropanoid ester
γ-Muurolene	23.62*	1457	0.19	0.07	1613	10.95	Sesquiterpene
(*Z*)-Cinnamic acid	23.62*	1457	[0.19]	0.06	2415	45.56*	Phenylpropanoid
(*Z*)-o-Methoxycinnamaldehyde?	23.77	1458	0.11				Phenylpropanoid
ar-Curcumene	24.68	1470	0.02	0.02	1708	15.14	Sesquiterpene
α-Muurolene	25.83	1484	0.04	0.03	1645	12.38	Sesquiterpene
γ-Cadinene	26.79	1495	0.03	0.03	1668	13.36	Sesquiterpene
β-Bisabolene	27.06	1499	0.05	0.04	1659	12.96	Sesquiterpene
δ-Cadinene	27.46	1504	0.08	0.07	1674	13.64	Sesquiterpene
trans-Calamenene	27.75	1507	0.02	0.03	1736	16.67	Sesquiterpene
trans-γ-Bisabolene	28.40	1516	0.04	0.07	1684	14.08	Sesquiterpene
(*E*)-o-Methoxycinnamaldehyde	30.41	1542	7.92	7.99	2316	43.40	Phenylpropanoid
Caryophyllene oxide	32.23*	1566	0.34	0.13	1851	23.83	Sesquiterp. ether
(*E*)-Nerolidol	32.23*	1566	[0.34]	0.09	1996	33.28	Sesquiterp. alcohol

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Spathulenol	32.23*	1566	[0.34]	0.08	2023	34.88	Sesquiterp. alcohol
α-Eudesmol	36.82	1644	0.04	0.04	2129	38.68	Sesquiterp. alcohol
(*E*)-o-Methoxycinnamyl acetate	38.46	1683	0.09	[0.06]	2415	45.56*	Phenylpropanoid ester
Benzyl benzoate	41.26	1763	0.76	0.76	2489	47.03	Phenolic ester
Phenylethyl benzoate	43.81	1850	0.04	0.04	2574	48.68	Phenolic ester
Total identified			**99.33%**	**98.73%**			

*: 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

Note: no correction factor was applied

Other Data

Physical aspect : Slightly yellow liquid
Refractive index : 1.5915 ± 0.0003 (20 °C)

Conclusion

The sample contains *Cinnamomum cassia* in addition to what is labelled. This can be told from the presence of coumarin, (*E*)-o-methoxycinnamaldehyde or phenylethyl alcohol, all characteristic of cassia oils. Furthermore, it does not seem either to be a pure cassia oil given the high contents of eugenol (should be below 0.5% according to the ISO norm, and while some variation may occur, the observed 4% is clearly off the range) and linalool (usually below 0.20% in samples we have analyzed previously for genuine cassia). All in all, this sample likely is a mixture of both *Cinnamomum cassia* and *Cinnamomum verum*.

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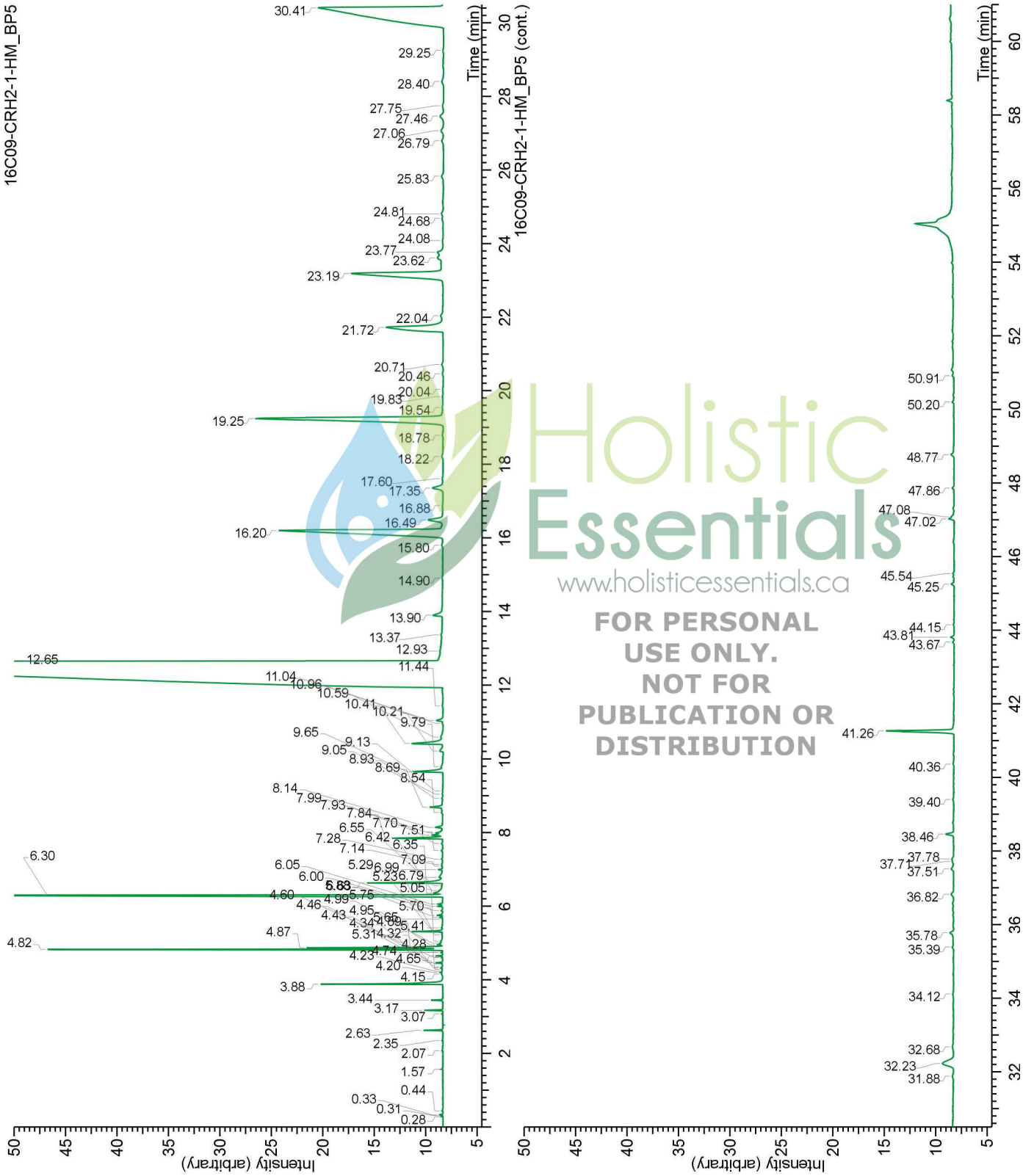

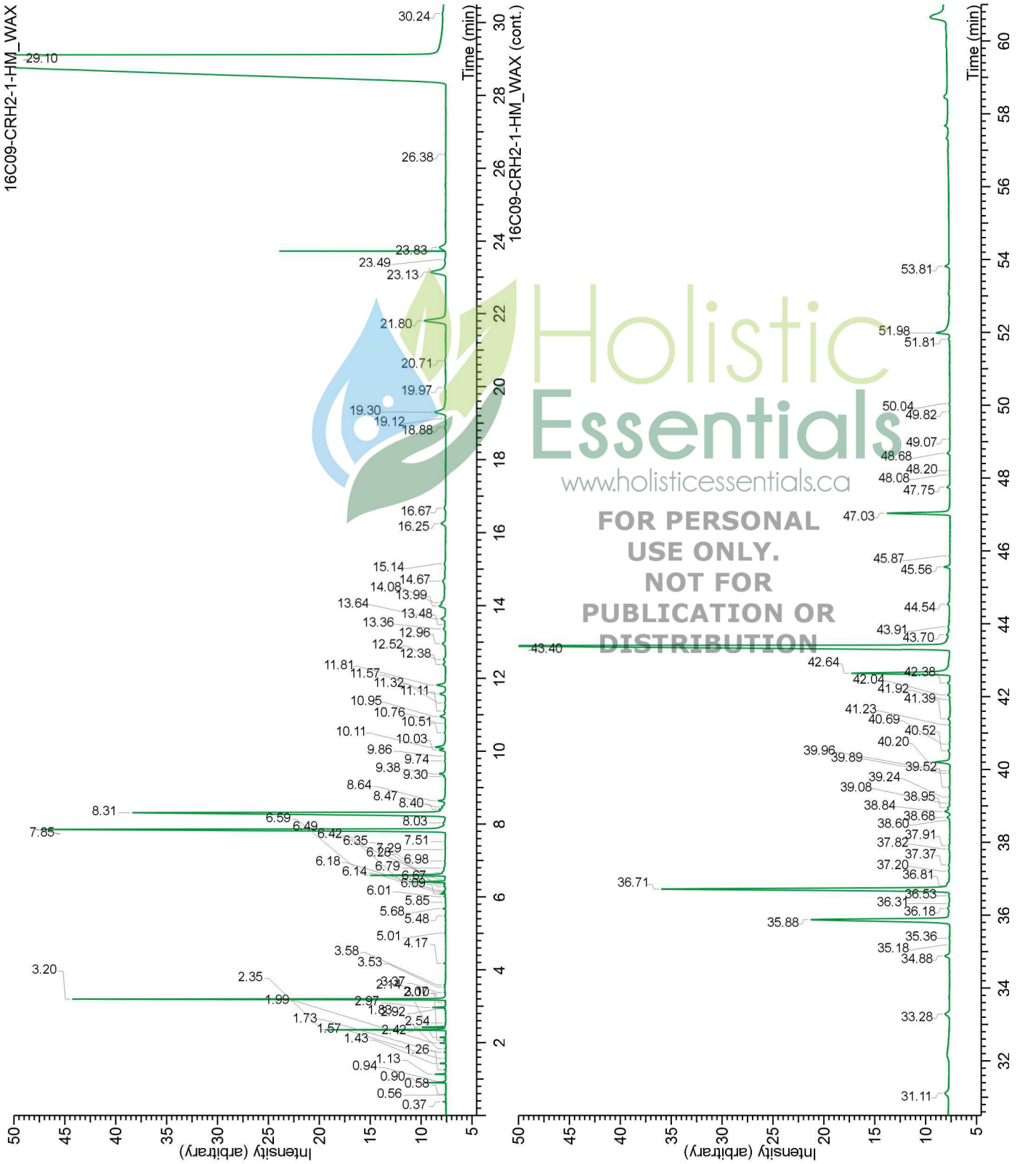

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