

Date : March 16, 2021

CERTIFICATE OF ANALYSIS – GC PROFILING

SAMPLE IDENTIFICATION

**Internal code :** 21B23-FEP33

**Customer identification :** Ylang Ylang III - Madagascar - 216896-19

**Type :** Essential oil

**Source :** Cananga odorata var. genuina (Ylang-ylang)

**Customer :** Fern & Petal

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 :** Sylvain Mercier, M. Sc., Chimiste

**Analysis date :** March 16, 2021

Checked and approved by :

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

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

**Physical aspect:** Light yellow liquid

**Refractive index:**  $1.5129 \pm 0.0003$  (20 °C; method PC-MAT-016)

#### *C*ONCLUSION

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
3-Buten-2-one	0.03	Aliphatic ketone
2-Methyl-3-buten-2-ol	0.01	Aliphatic alcohol
Toluene	0.01	Simple phenolic
Unknown	0.07	Unknown
3-Methyl-3-but enyl acetate	0.01	Aliphatic ester
Prenyl acetate	0.04	Aliphatic ester
α-Pinene	0.07	Monoterpene
Benzaldehyde	0.02	Simple phenolic
β-Pinene	0.02	Monoterpene
6-Methyl-5-hepten-2-one	0.12	Aliphatic ketone
Myrcene	0.04	Monoterpene
ortho-Methylanisole	0.01	Simple phenolic
(3Z)-Hexenyl acetate	0.01	Aliphatic ester
para-Methylanisole	0.55	Simple phenolic
meta-Methylanisole	0.03	Simple phenolic
(2E)-Hexenyl acetate	0.01	Aliphatic ester
1,8-Cineole	0.03	Monoterpenic ether
Limonene	0.02	Monoterpene
Benzyl alcohol	0.04	Simple phenolic
(Z)-β-Ocimene	0.02	Monoterpene
(E)-β-Ocimene	0.01	Monoterpene
cis-Sabinene hydrate	0.01	Monoterpenic alcohol
cis-Linalool oxide (fur.)	0.02	Monoterpenic alcohol
Terpinolene	0.01	Monoterpene
Methyl benzoate	0.34	Phenolic ester
Linalool	1.50	Monoterpenic alcohol
Camphor	0.02	Monoterpenic ketone
ortho-Dimethoxybenzene	0.02	Simple phenolic
Benzyl acetate	0.96	Phenolic ester
para-Cresyl acetate	tr	Phenolic ester
Ethyl benzoate	0.02	Phenolic ester
α-Terpineol	0.07	Monoterpenic alcohol
Methyl salicylate	0.01	Phenolic ester
Methylchavicol	0.03	Phenylpropanoid
Nerol	0.02	Monoterpenic alcohol
Neral	0.01	Monoterpenic aldehyde
Geraniol	0.40	Monoterpenic alcohol
Linalyl acetate	0.03	Monoterpenic ester
Chavicol	0.01	Phenylpropanoid
Geranial	0.04	Monoterpenic aldehyde
(E)-Anethole	0.02	Phenylpropanoid
1-Nitro-2-phenylethane	0.02	Simple phenolic
(E)-Cinnamyl alcohol	0.01	Phenylpropanoid
4-Vinylguaiacol	0.01	Simple phenolic
δ-Elemene	0.04	Sesquiterpene

Bicycloelemene	0.15	Sesquiterpene
Benzyl butyrate	0.02	Phenolic ester
$\alpha$ -Cubebene	0.23	Sesquiterpene
Eugenol	0.10	Phenylpropanoid
Unknown	0.03	Sesquiterpene
$\alpha$ -Ylangene	0.01	Sesquiterpene
Neryl acetate	0.04	Monoterpenic ester
$\alpha$ -Copaene	1.64	Sesquiterpene
$\beta$ -Bourbonene	0.04	Sesquiterpene
Geranyl acetate	2.56	Monoterpenic ester
$\beta$ -Cubebene	0.23	Sesquiterpene
$\beta$ -Elemene	0.56	Sesquiterpene
Vanillin	0.05	Simple phenolic
Cyperene	0.02	Sesquiterpene
Sibirene	0.02	Sesquiterpene
Isocaryophyllene	0.03	Sesquiterpene
$\alpha$ -Gurjunene	0.03	Sesquiterpene
Methyleugenol	0.04	Phenylpropanoid
$\beta$ -Caryophyllene	14.79	Sesquiterpene
$\beta$ -Copaene	0.12	Sesquiterpene
Caryophylla-4(12),8(13)-diene	0.08	Sesquiterpene
Aromadendrene	0.14	Sesquiterpene
Isogermacrene D	0.05	Sesquiterpene
(E)-Cinnamyl acetate	1.04	Phenylpropanoid ester
(E)-Isoeugenol	0.14	Phenylpropanoid
$\alpha$ -Humulene	3.33	Sesquiterpene
cis-Cadina-1(6),4-diene	0.06	Sesquiterpene
cis-Muurola-4(15),5-diene	0.18	Sesquiterpene
trans-Cadina-1(6),4-diene	0.17	Sesquiterpene
Germacrene D	13.14	Sesquiterpene
$\gamma$ -Muurolene	2.45	Sesquiterpene
$\gamma$ -Amorphene	0.36	Sesquiterpene
Prenyl benzoate	0.14	Phenolic ester
Bicyclogermacrene	0.20	Sesquiterpene
epi-Cubebol	0.07	Sesquiterpenic alcohol
(3Z,6E)- $\alpha$ -Farnesene	0.04	Sesquiterpene
$\alpha$ -Muurolene	1.14	Sesquiterpene
Unknown	0.51	Sesquiterpene
$\delta$ -Amorphene	0.80	Sesquiterpene
Cubebol	0.09	Sesquiterpenic alcohol
$\gamma$ -Cadinene	1.30	Sesquiterpene
(3E,6E)- $\alpha$ -Farnesene	6.36	Sesquiterpene
trans-Calamenene	0.54	Sesquiterpene
$\delta$ -Cadinene	3.25	Sesquiterpene
trans-Cadina-1,4-diene	0.16	Sesquiterpene
$\alpha$ -Cadinene	0.35	Sesquiterpene
Guaiacylacetone	0.02	Phenylpropanoid
$\alpha$ -Calacorene	0.09	Sesquiterpene
cis-Dracunculifoliol	0.04	Sesquiterpenic alcohol
$\alpha$ -Elemol	0.14	Sesquiterpenic alcohol
Germacrene B	0.11	Sesquiterpene
Sesquirosefuran?	0.12	Sesquiterpenic ether

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$\beta$ -Calacorene	0.15	Sesquiterpene
(3Z)-Hexenyl benzoate	0.12	Phenolic ester
Spathulenol	0.15	Sesquiterpenic alcohol
Caryophyllene oxide	1.14	Sesquiterpenic ether
Caryophyllene oxide isomer	0.25	Sesquiterpenic ether
<i>trans</i> -Dracunculifoliol	0.09	Sesquiterpenic alcohol
Unknown	0.07	Sesquiterpenic alcohol
Unknown	0.11	Oxygenated sesquiterpene
Viridiflorol	0.11	Sesquiterpenic alcohol
Humulene epoxide I	0.09	Sesquiterpenic ether
Guaiol	0.10	Sesquiterpenic alcohol
Copaborneol	0.10	Sesquiterpenic alcohol
Humulene epoxide II	0.26	Sesquiterpenic ether
10-epi-Cubenol	0.21	Sesquiterpenic alcohol
Junenol	0.38	Sesquiterpenic alcohol
(E)-Isoeugenyl acetate	0.10	Phenylpropanoid ester
1-epi-Cubenol	0.43	Sesquiterpenic alcohol
$\gamma$ -Eudesmol	0.25	Sesquiterpenic alcohol
Unknown	1.72	Unknown
$\tau$ -Cadinol	0.47	Sesquiterpenic alcohol
$\tau$ -Muurolol	1.06	Sesquiterpenic alcohol
$\alpha$ -Muurolol	0.70	Sesquiterpenic alcohol
Unknown	0.34	Sesquiterpenic alcohol
$\alpha$ -Cadinol	2.39	Sesquiterpenic alcohol
<i>trans</i> -Calamenen-10-ol	0.79	Sesquiterpenic alcohol
Unknown	0.32	Oxygenated sesquiterpene
Eudesma-4(15),7-dien-1 $\beta$ -ol	0.08	Sesquiterpenic alcohol
(2E,6Z)-Farnesol	0.07	Sesquiterpenic alcohol
(2E,6E)-Farnesol	1.88	Sesquiterpenic alcohol
(2E,6E)-Farnesal	0.22	Sesquiterpenic aldehyde
Benzyl benzoate	7.72	Phenolic ester
Unknown	0.12	Oxygenated sesquiterpene
(2E,6E)-Farnesyl acetate	3.49	Sesquiterpenic ester
Benzyl salicylate	4.05	Phenolic ester
Unknown	0.16	Unknown
Unknown	0.27	Unknown
Unknown	0.22	Unknown
Geranyl benzoate	0.15	Phenolic ester
Unknown	0.07	Unknown
Unknown	0.06	Unknown
Unknown	0.01	Unknown
Unknown	0.04	Unknown
<b>Consolidated total</b>	<b>92.60%</b>	

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.

Essential oil, *Cananga odorata* var. *genuina* (*Ylang-ylang*)

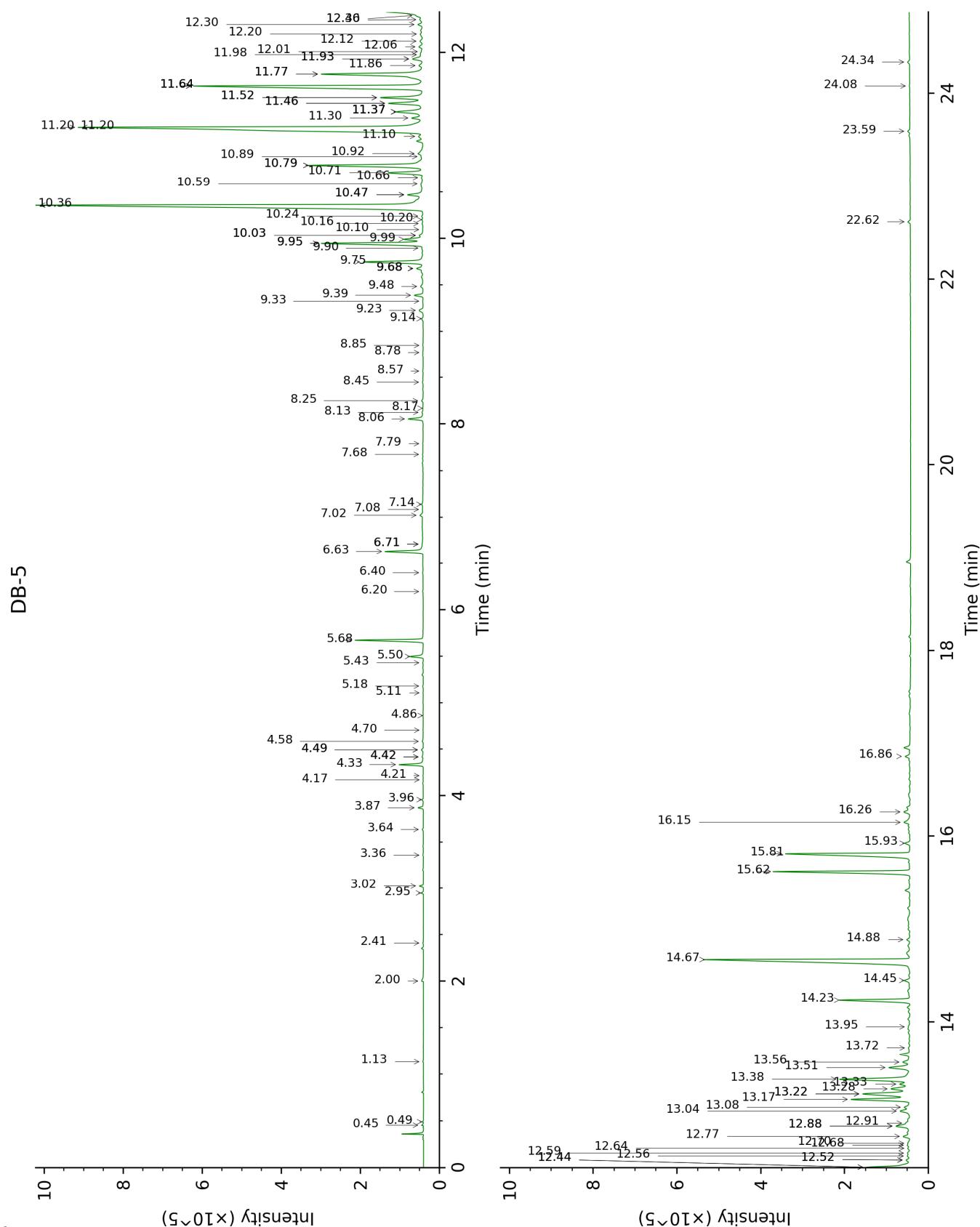
Internal code: 21B23-FEP33

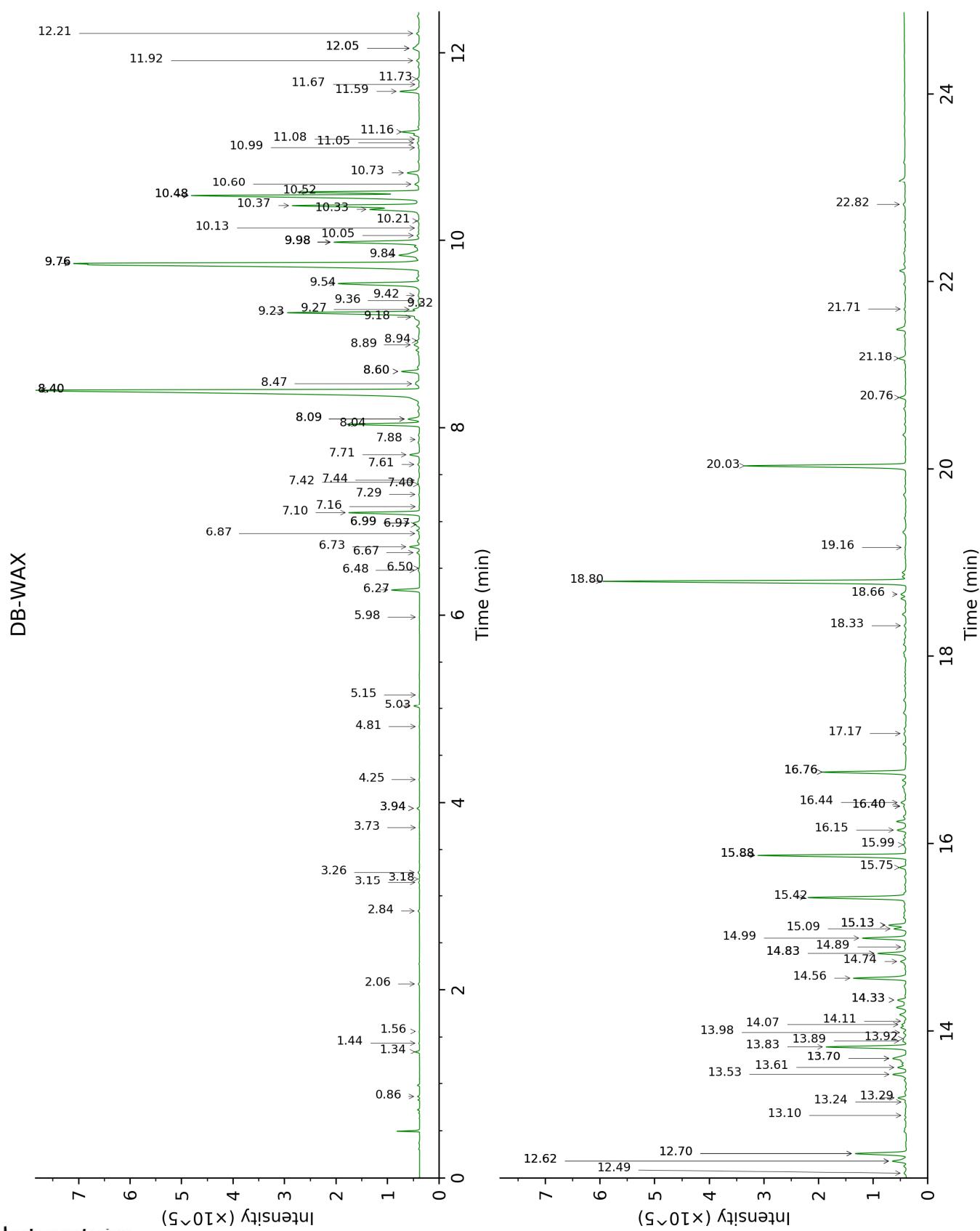
Ylang Ylang III - Madagascar - 216896-19

Report prepared for

Fern & Petal

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





FULL ANALYSIS DATA

Identification	Column DB-5			Column DB-WAX		
	R.T	R.I	%	R.T	R.I	%
3-Buten-2-one	0.45	571	0.03	0.86	912	0.03
2-Methyl-3-buten-2-ol	0.49	601	0.01	1.56	1016	0.01
Toluene	1.13	759	0.01	1.44	1003	0.01
Unknown [m/z 43, 72 (40), 57 (15)... 98 (4)]	2.00	851	0.07	6.67	1415	0.06
3-Methyl-3-butenyl acetate	2.41	885	0.01	3.18	1160	0.01
Prenyl acetate	2.95	925	0.04	3.94*	1217	0.05
α-Pinene	3.02	930	0.07	1.34	991	0.07
Benzaldehyde	3.36	952	0.02	7.29	1462	0.02
β-Pinene	3.64	970	0.02	2.06	1065	0.03
6-Methyl-5-hepten-2-one	3.87	986	0.12	5.03	1296	0.12
Myrcene	3.96	992	0.04	2.84	1133	0.03
ortho-Methylanisole	4.17	1006	0.01	5.98	1365	0.01
(3Z)-Hexenyl acetate	4.21	1008	0.01	4.81	1280	0.01
para-Methylanisole	4.33	1016	0.55	6.27	1386	0.58
meta-Methylanisole	4.42*	1021	0.05	6.48	1401	0.03
(2E)-Hexenyl acetate	4.42*	1021	[0.05]	5.15	1305	0.01
1,8-Cineole	4.49*	1026	0.06	3.26	1165	0.03
Limonene	4.49*	1026	[0.06]	3.14	1157	0.02
Benzyl alcohol	4.58	1032	0.04	11.73	1820	0.06
(Z)-β-Ocimene	4.70	1039	0.02	3.73	1202	0.01
(E)-β-Ocimene	4.86	1049	0.01	3.94*	1217	[0.05]
cis-Sabinene hydrate	5.11	1065	0.01	6.87	1430	0.02
cis-Linalool oxide (fur.)	5.18	1070	0.02	6.50	1402	0.01
Terpinolene	5.43	1085	0.01	4.25	1239	0.02
Methyl benzoate	5.50	1090	0.34	8.60*	1562	0.42
Linalool	5.68	1101	1.50	8.04	1518	1.55
Camphor	6.20	1134	0.02	7.16	1452	0.01
ortho-Dimethoxybenzene	6.40	1147	0.02			
Benzyl acetate	6.63	1162	0.96	9.98*	1672	2.29
para-Cresyl acetate	6.70*	1167	0.02			
Ethyl benzoate	6.70*	1167	[0.02]	9.32	1619	0.02
α-Terpineol	7.02	1188	0.07	9.76*	1654	14.51
Methyl salicylate	7.08	1192	0.01	10.48*†	1713	9.40
Methylchavicol	7.14	1195	0.03	9.36	1622	0.04
Nerol	7.68	1231	0.02	10.99	1757	0.02
Neral	7.79	1239	0.01	9.42	1626	0.04

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Geraniol	8.06	1257	0.40	11.59	1808	0.45
Linalyl acetate	8.13	1262	0.03	8.09*	1522	0.30
Chavicol	8.17	1265	0.01	16.40*	2268	0.10
Geranial	8.25	1270	0.04	10.05	1678	0.06
(E)-Anethole	8.45	1284	0.02	11.08	1765	0.02
1-Nitro-2-phenylethane	8.57	1292	0.02	14.11	2040	0.05
(E)-Cinnamyl alcohol	8.78	1306	0.01	15.88*	2214	3.41
4-Vinylguaiacol	8.85	1312	0.01	15.09†	2135	0.69
δ-Elemene	9.14	1332	0.04	6.97	1437	0.06
Bicycloelemene	9.23	1334	0.15	6.99*	1439	0.16
Benzyl butyrate	9.33	1341	0.02	11.67	1815	0.01
α-Cubebene	9.39	1345	0.23	6.73	1419	0.22
Eugenol	9.48	1352	0.10	14.74	2100	0.15
Unknown [m/z 189, 91 (89), 82 (78), 109 (72), 93 (68), 67 (63), 161 (59)... 204 (tr)]	9.68*	1366	0.22	7.44	1473	0.03
α-Ylangene	9.68*	1366	[0.22]	6.99*	1439	[0.16]
Neryl acetate	9.68*	1366	[0.22]	10.13	1685	0.04
α-Copaene	9.75	1371	1.64	7.10	1447	1.61
β-Bourbonene	9.90	1381	0.04	7.42	1471	0.05
Geranyl acetate	9.95*	1385	2.79	10.52†	1716	[9.40]
β-Cubebene	9.95*	1385	[2.79]	7.71	1493	0.23
β-Elemene	9.99	1388	0.56	8.40*	1546	15.46
Vanillin	10.03*	1391	0.12	18.33	2478	0.05
Cyperene	10.03*	1391	[0.12]	7.40	1470	0.02
Sibirene	10.10	1395	0.02	7.88	1505	0.01
Isocaryophyllene	10.16	1400	0.03	8.09*	1522	[0.30]
α-Gurjunene	10.20	1403	0.03	7.61	1485	0.04
Methyleugenol	10.24	1405	0.04	13.24	1959	0.05
β-Caryophyllene	10.36	1414	14.79	8.40*	1546	[15.46]
β-Copaene	10.47*	1422	0.57	8.40*	1546	[15.46]
Caryophylla-4(12),8(13)-diene	10.47*	1422	[0.57]	8.60*	1562	[0.42]
Aromadendrene	10.59	1431	0.14	8.47	1552	0.17
Isogermacrene D	10.66	1436	0.05	8.94	1588	0.06
(E)-Cinnamyl acetate	10.71	1440	1.04	14.56	2083	1.23
(E)-Isoeugenol	10.79*	1446	3.53	16.44	2272	0.14
α-Humulene	10.79*	1446	[3.53]	9.23	1611	3.33
cis-Cadin-1(6),4-diene	10.89	1453	0.06	8.89	1584	0.18
cis-Muurola-4(15),5-diene	10.92	1456	0.18	9.27	1614	0.14
trans-Cadin-1(6),4-diene	11.10	1470	0.17	9.18	1607	0.15
Germacrene D	11.20*	1477	15.59	9.76*	1654	[14.51]
γ-Muurolene	11.20*	1477	[15.59]	9.54	1637	2.45
γ-Amorphene	11.30	1484	0.36	9.76*	1654	[14.51]

Prenyl benzoate	11.37*	1489	1.05	13.70*†	2001	0.56
Bicyclogermacrene	11.37*	1489	[1.05]	9.98*	1672	[2.29]
epi-Cubebol	11.37*	1489	[1.05]	11.92	1837	0.07
(3Z,6E)- $\alpha$ -Farnesene	11.46*	1496	1.18	10.21	1691	0.04
$\alpha$ -Muurolene	11.46*	1496	[1.18]	9.98*	1672	[2.29]
Unknown [m/z 119, 41 (95), 123 (53), 80 (49), 161 (44), 105 (42)... 204 (2)]	11.52*	1500	1.31			
$\delta$ -Amorphene	11.52*	1500	[1.31]	9.84	1661	0.80
Cubebol	11.64*	1510	7.75	12.49	1888	0.09
$\gamma$ -Cadinene	11.64*	1510	[7.75]	10.33	1701	1.30
(3E,6E)- $\alpha$ -Farnesene	11.64*	1510	[7.75]	10.48*†	1713	[9.40]
trans-Calamenene	11.77*	1520	3.73	11.16	1772	0.54
$\delta$ -Cadinene	11.77*	1520	[3.73]	10.37	1704	3.25
trans-Cadina-1,4-diene	11.86	1527	0.16	10.60	1724	0.16
$\alpha$ -Cadinene	11.93*	1533	0.41	10.73	1734	0.35
Guaiacylacetone	11.93*	1533	[0.41]	19.16	2574	0.02
$\alpha$ -Calacorene	11.98	1536	0.09	12.05*	1849	0.29
cis-Dracunculifoliol	12.01	1539	0.04	12.05*	1849	[0.29]
$\alpha$ -Elemol	12.06	1543	0.14	13.98	2028	0.08
Germacrene B	12.12	1548	0.11	11.05	1762	0.06
Sesquirosefuran?	12.20	1554	0.12			
$\beta$ -Calacorene	12.30	1562	0.15	12.62*	1899	0.40
(3Z)-Hexenyl benzoate	12.36	1566	0.12	14.33*	2061	0.24
Spathulenol	12.40	1570	0.15	14.33*	2061	[0.24]
Caryophyllene oxide	12.44*	1573	1.75	12.70*	1909	1.23
Caryophyllene oxide isomer	12.44*	1573	[1.75]	12.62*	1899	[0.40]
trans-Dracunculifoliol	12.52*	1579	0.16	12.70*	1909	[1.23]
Unknown cadinol or muurolol analog [m/z 161, 119 (77), 120 (76), 105 (73), 93 (57)... 204 (36)]	12.52*	1579	[0.16]	12.21	1863	0.07
Unknown [m/z 161, 105 (84), 43 (80), 119 (72), 93 (62), 121 (54)... 204 (38), 222 (2)]	12.56	1582	0.11	13.90	2020	0.09
Viridiflorol	12.59	1584	0.11	13.92	2022	0.09
Humulene epoxide I	12.64	1589	0.09	13.10	1946	0.04
Guaiol	12.68	1591	0.10	14.07	2036	0.11
Copaborneol	12.70	1593	0.10	14.89	2116	0.05
Humulene epoxide II	12.77	1598	0.26	13.29	1963	0.21

10-epi-Cubenol	12.88*	1607	0.59	13.61	1992	0.21
Junenol	12.88*	1607	[0.59]	13.53	1986	0.38
(E)-Isoeugenyl acetate	12.91	1610	0.10	17.17	2350	0.08
1-epi-Cubenol	13.04	1620	0.43	13.70*†	2001	[0.56]
γ-Eudesmol	13.08	1624	0.25	14.83*	2109	0.72
Unknown [m/z 43, 93 (89), 91 (88), 79 (87), 123 (76), 81 (75)…]	13.17	1631	1.72	13.83	2014	1.84
τ-Cadinol	13.22*	1636	1.80	14.83*	2109	[0.72]
τ-Muurolol	13.22*	1636	[1.80]	14.99	2125	1.06
α-Muurolol	13.28	1640	0.70	15.13*†	2139	[0.69]
Unknown cadinol analog II [m/z 95, 121 (73), 43 (57), 79 (43), 161 (43), 109 (40)... 204 (35), 222 (2)]	13.33	1644	0.34	15.13*†	2139	[0.69]
α-Cadinol	13.38	1648	2.39	15.42	2168	2.40
<i>trans</i> -Calamenen-10-ol	13.50	1659	0.79	16.76*	2306	1.87
Unknown [m/z 123, 95 (31), 81 (29), 105 (27)... 222 (5)]	13.56	1664	0.32	16.15	2242	0.23
Eudesma-4(15),7-dien-1β-ol	13.72	1677	0.08	15.99	2226	0.09
(2E,6Z)-Farnesol	13.95	1695	0.07	16.40*	2268	[0.10]
(2E,6E)-Farnesol	14.24	1720	1.88	16.76*	2306	[1.87]
(2E,6E)-Farnesal	14.45	1738	0.22	15.75	2201	0.17
Benzyl benzoate	14.67	1757	7.72	18.80	2532	7.41
Unknown [m/z 123, 43 (86), 179 (71), 81 (66), 95 (59), 79 (55)…]	14.88	1776	0.12			
(2E,6E)-Farnesyl acetate	15.62	1841	3.49	15.88*	2214	[3.41]
Benzyl salicylate	15.81	1859	4.05	20.03	2678	3.99
Unknown [m/z 91, 93 (98), 81 (92), 41 (92), 105 (86), 107 (86)…]	15.93	1869	0.16	20.76	2767	0.16
Unknown [m/z 123, 81 (96), 41 (74), 43 (64), 91 (62), 95 (57)…]	16.15	1889	0.27			
Unknown [m/z 123, 81 (47), 43 (35), 91 (30), 41 (27), 79 (24)…]	16.26	1899	0.22	21.18	2820	0.20
Geranyl benzoate	16.86	1956	0.15	18.66	2516	0.15

Unknown [m/z 326, 311 (47), 327 (22), 202 (16), 137 (15)...]	22.62	2574	0.07			
Unknown [m/z 69, 83 (59), 81 (56), 137 (48), 41 (29), 139 (28)...]	23.59	2694	0.06	21.71	2888	0.04
Unknown [m/z 69, 81 (44), 147 (31), 41 (26), 119 (26), 93 (24)...]	24.08	2757	0.01			
Unknown [m/z 69, 81 (42), 147 (26), 119 (25), 93 (25), 41 (24)...]	24.34	2790	0.04	22.82	3037	0.07
<b>Total identified</b>	<b>90.99%</b>			<b>89.08%</b>		
<b>Total reported</b>	<b>94.49%</b>			<b>91.86%</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

Note: no correction factor was applied

R.T.: Retention time (minutes)

R.I.: Retention index