

GC/MS BATCH NUMBER: Y50100

ESSENTIAL OIL: BLUE YARROW ORGANIC
BOTANICAL NAME: ACHILLEA MILLEFOLIUM
ORIGIN: BULGARIA

KEY CONSTITUENTS PRESENT IN THIS BATCH OF BLUE YARROW ORGANIC OIL	%
SABINENE	21.5
β-PINENE	13.2
β-CARYOPHYLLENE	11.2
ARTEMISIA KETONE	5.4
CHAMAZULENE	5.3
1,8-CINEOLE	3.8
TERPINEN-4-OL	2.7
α-PINENE	2.3
CARYOPHYLLENE OXIDE	1.9
α-HUMULENE	1.4

Comments from Robert Tisserand: A beautiful and complex yarrow oil with 5% chamazulene.

Date : November 25, 2016

SAMPLE IDENTIFICATION

Internal code : 16K14-PTH22-1-DM

Customer identification : Org Yarrow - Y5010067R

Type : Essential oil

Source : *Achillea millefolium*

Customer : Plant Therapy

ANALYSIS

Method : PC-PA-001-15E06, "Analysis of the composition of a liquid essential oil by GC-FID" (in French).

Analyst : Sylvain Mercier, M. Sc., chimiste

Analysis date : 2016-11-22

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.	
Isoamyl alcohol	1.15	729	tr	tr	1164	2.55	Aliphatic alcohol
2-Methylbutyl alcohol	1.17	732	0.01	0.01	1161	2.52	Aliphatic alcohol
Octene	1.44	770	0.03	0.03	715	0.40	Alkene
Hexanal	1.67	801	0.02	0.02	1017	1.18	Aliphatic aldehyde
<i>cis</i> -Hex-3-en-1-ol	2.51	866	0.01	0.01	1312	4.49	Aliphatic alcohol
Santolinatriene	2.90	897	0.21	0.28	958	0.91	Monoterpene
Tricyclene	3.17	913	0.02	0.01	922	0.77	Monoterpene
α -Thujene	3.26	918	0.40	0.50	948	0.87	Monoterpene
α -Pinene	3.37	925	2.33	2.19	942	0.84	Monoterpene
α -Fenchene	3.59	939	0.01	0.02	980	1.00	Monoterpene
Camphene	3.64	942	0.21	0.22	990	1.05	Monoterpene
Propyl 2-methylbutyrate	3.74	948	0.01	0.02	1086	1.73	Aliphatic ester
Sabinene	4.15	973	21.51	21.47	1060	1.53	Monoterpene
β -Pinene	4.21	976	13.18	13.89	1041	1.38	Monoterpene
Myrcene	4.43	989	0.64	0.59	1110	1.94	Monoterpene
Octen-3-ol	4.50	994	0.03	0.03	1411	5.92	Aliphatic alcohol
Δ 3-Carene	4.69*	1005	0.05	0.01	1100	1.85	Monoterpene
α -Phellandrene	4.69*	1005	[0.05]	0.02	1102	1.87	Monoterpene
Yomogi alcohol	4.71	1006	0.21	0.24	1348	5.02	Monoterp. alcohol
α -Terpinene	4.88	1015	0.42	0.42	1118	2.01	Monoterpene
Limonene	5.11*	1028	1.19	0.64	1136	2.23	Monoterpene
<i>para</i> -Cymene	5.11*	1028	[1.19]	0.36	1200	2.97	Monoterpene
1,8-Cineole	5.18	1032	3.76	3.78	1141	2.29	Monoterp. ether
<i>cis</i> - β -Ocimene	5.29	1038	0.22	0.84	1182	2.76*	Monoterpene
<i>trans</i> - β -Ocimene	5.47	1048	0.53	0.49	1195	2.92	Monoterpene
γ -Terpinene	5.66	1058	0.70	[0.84]	1182	2.76*	Monoterpene
Artemisia ketone	5.77	1064	5.38	5.40	1285	4.10	Monoterp. ketone
<i>cis</i> -Sabinene hydrate	6.01	1077	0.21	0.23	1399	5.75	Monoterp. alcohol
Terpinolene	6.13	1083	0.24	0.21	1218	3.19	Monoterpene
Artemisia alcohol	6.19	1087	0.25	0.25	1439	6.42	Monoterp. alcohol
Linalool	6.66*	1107	0.72	0.64	1483	7.22	Monoterp. alcohol
<i>trans</i> -Sabinene hydrate	6.66*	1107	[0.72]	0.13	1470	6.99	Monoterp. alcohol
Nonanal	6.70	1109	0.11	0.08	1332	4.77	Aliphatic aldehyde
α -Thujone	6.76	1111	0.02	0.01	1361	5.19	Monoterp. ketone
β -Thujone	6.93	1117	0.02	0.02	1373	5.36	Monoterp. ketone
α -Campholenal	7.16	1126	0.08				Monoterp. aldehyde
<i>trans</i> -Pinocarveol	7.56	1141	0.14	0.10	1555	8.98	Monoterp. alcohol
Camphor	7.66	1145	0.45	0.43	1416	5.99	Monoterp. ketone
Pinocarvone	8.07	1160	0.31	0.59	1494	7.45	Monoterp. ketone
Artemisyl acetate	8.19	1164	0.34	0.31	1364	5.24	Monoterp. ester
<i>cis</i> -Chrysanthemol	8.34	1170	0.26	9.91	1629	11.21*	Monoterp. alcohol

Borneol	8.63	1181	0.16	0.14	1607	10.50	Monoterp. alcohol
Terpinen-4-ol	8.76	1186	2.70	6.79	1528	8.15*	Monoterp. alcohol
Myrtenal	9.20	1200	0.09	0.05	1538	8.45	Monoterp. aldehyde
Myrtenol	9.33	1203	0.01	0.01	1712	14.84	Monoterp. alcohol
Methylchavicol	9.39*	1204	0.48	0.16	1587	9.88	Phenylpropanoid
α -Terpineol	9.39*	1204	[0.48]	0.61	1617	10.80*	Monoterp. alcohol
Verbenone	9.89	1215	0.05	0.05	1595	10.15	Monoterp. ketone
Bornyl formate	10.21	1223	0.05	0.06	1443	6.49	Monoterp. ester
Linalyl acetate	11.26	1246	0.40	0.38	1490	7.36	Monoterp. ester
Geraniol	11.85	1259	0.03	0.03	1792	19.24	Monoterp. alcohol
4-Thujen-2- α -yl acetate?	12.19	1267	0.76	0.79	1546	8.68	Monoterp. ester
Bornyl acetate	12.74	1279	0.77	7.43	1525	8.05*	Monoterp. ester
<i>cis</i> -Chrysanthemyl acetate	13.06	1286	0.43	0.42	1543	8.60	Monoterp. ester
Lavandulyl acetate	13.21	1289	0.14	0.14	1559	9.05	Monoterp. ester
<i>trans</i> -Pinocarvyl acetate	13.43	1294	0.07	0.37	1534	8.31*	Monoterp. ester
δ -Elemene	15.06	1319	0.04	0.04	1425	6.13	Sesquiterpene
Carvacrol	15.85	1332	0.03	0.03	2143	38.36	Monoterp. alcohol
α -Terpinyl acetate	16.43	1340	0.07	0.21	1610	10.57	Monoterp. ester
α -Ylangene	16.89	1347	0.02	0.02	1421	6.06	Sesquiterpene
α -Copaene	17.40	1355	0.07	0.09	1434	6.31	Sesquiterpene
Neryl acetate	17.66	1359	0.07	0.10	1663	12.69	Monoterp. ester
β -Bourbonene	17.85	1362	0.63	0.62	1453	6.67	Sesquiterpene
β -Elemene	18.63	1374	0.03	[6.79]	1528	8.15*	Sesquiterpene
Geranyl acetate	19.21	1383	0.07	0.08	1682	13.55	Monoterp. ester
β -Caryophyllene	20.55	1402	11.21	[7.43]	1525	8.05*	Sesquiterpene
β -Copaene	21.20	1410	0.10	0.11	1503	7.61	Sesquiterpene
Aromadendrene	21.84	1418	0.06	[0.37]	1534	8.31*	Sesquiterpene
α -Himachalene	22.62	1427	0.30	0.28	1574	9.53	Sesquiterpene
α -Humulene	23.11	1433	1.42	1.46	1580	9.72	Sesquiterpene
<i>trans</i> - β -Farnesene	24.29	1447	0.30	0.38	1615	10.72	Sesquiterpene
Germacrene D	25.56*	1462	9.69	[9.91]	1629	11.21*	Sesquiterpene
γ -Muurolene	25.56*	1462	[9.69]	[0.61]	1617	10.80*	Sesquiterpene
Bicyclgermacrene	26.53	1473	0.46	0.45	1642	11.78	Sesquiterpene
<i>trans</i> - β -Bergamotene?	27.51	1485	0.77	0.84	1653	12.27	Sesquiterpene
γ -Cadinene	28.31	1495	0.07	0.06	1666	12.84	Sesquiterpene
(<i>E,E</i>)- α -Farnesene	28.76	1501	0.16	0.50	1692	13.95*	Sesquiterpene
δ -Cadinene	28.96	1504	0.26	0.27	1672	13.08	Sesquiterpene
<i>trans</i> -Cadina-1,4-diene	29.84	1516	0.23	[0.50]	1692	13.95*	Sesquiterpene
α -Elemol	32.44	1551	0.05	0.04	1996	32.16	Sesquiterp. alcohol
Caryophyllene oxide	33.62*	1567	2.03	1.87	1847	22.49	Sesquiterp. ether
Spathulenol	33.62*	1567	[2.03]	0.09	2019	33.52	Sesquiterp. alcohol
(<i>E</i>)-Nerolidol	33.74*	1569	0.47	0.37	1988	31.71	Sesquiterp. alcohol
Germacrene D-4-ol	33.74*	1569	[0.47]	0.05	1947	29.27	Sesquiterp. alcohol
Humulene epoxide II	35.25	1590	0.10	0.09	1895	25.85	Sesquiterp. ether

Isospathulenol	36.79	1624	0.10				Sesquiterp. alcohol
τ -Cadinol	37.36	1638	0.03	0.04	2067	35.78	Sesquiterp. alcohol
τ -Muurolol	37.49	1641	0.03	0.02	2084	36.35	Sesquiterp. alcohol
α -Muurolol	37.62	1644	0.02	0.03	2102	36.96	Sesquiterp. alcohol
β -Eudesmol	37.71	1646	0.15	0.08	2109	37.19	Sesquiterp. alcohol
α -Cadinol	37.93	1651	0.09	0.07	2124	37.70	Sesquiterp. alcohol
α -Bisabolol	39.33	1684	0.07	0.05	2132	37.96	Sesquiterp. alcohol
Chamazulene	40.57	1721	5.33	4.91	2230	40.70	Azulene
Phytone	44.26	1844	0.09	0.09	2088	36.51	Aliphatic ketone
<i>cis</i> -Spiroether	45.50	1888	0.04	0.04	2753	51.06	Polyyne
<i>trans</i> -Spiroether	45.67	1894	0.01				Polyyne
Total identified			95.04%	95.21%			

*: Two or more compounds are coeluting on this column

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

Note: no correction factor was applied

OTHER DATA

Physical aspect : Dark blue liquid

Refractive index : N/A

CONCLUSION

No adulterant, contaminant or diluent were detected using this method.



