

Date : January 10, 2016

SAMPLE IDENTIFICATION

Internal code : 16A04-ALK9-1-LC

Customer identification : B-PIMACAN12PC

Type : Essential oil

Source : *Picea mariana*

ANALYSIS

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

Analyst : Alexis St-Gelais, M. Sc., chimiste

Analysis date : 2016-01-06

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	1.30	787	0.02	0.01	1025	1.43	Aliphatic aldehyde
<i>cis</i> -Hex-3-en-1-ol	1.95	853	0.06	0.05	1342	5.28	Aliphatic alcohol
Santene	2.07	864	3.80	3.79	904	0.79	Normonoterpene
Hexanol	2.15	872	0.04	0.03	1316	4.89	Aliphatic alcohol
Tricyclene	2.59	909	1.89	1.90	927	0.90	Monoterpene
α -Thujene	2.68	915	0.19	15.61	959	1.04††	Monoterpene
α -Pinene	2.80	923	15.45	[15.61]	953	1.01††	Monoterpene
Camphene	3.06*	940	16.50	16.53	1008	1.28	Monoterpene
α -Fenchene	3.06*	940	[16.50]	0.06	995	1.20	Monoterpene
Thuja-2,4(10)-diene	3.12	944	0.07	0.29	1063	1.74*	Monoterpene
Sabinene	3.44	965	0.26	[0.29]	1063	1.74*	Monoterpene
β -Pinene	3.50	968	4.75	4.69	1045	1.59	Monoterpene
Myrcene	3.80	988	3.75	3.69	1122	2.32	Monoterpene
Δ 3-Carene	4.05*	1004	8.52	8.22	1099	2.04	Monoterpene
α -Phellandrene	4.05*	1004	[8.52]	0.35	1112	2.19	Monoterpene
<i>cis</i> -Hex-3-en-1-yl acetate	4.10	1007	0.05	0.06	1275	4.31	Aliphatic ester
α -Terpinene	4.20	1013	0.22	0.24	1126	2.35*	Monoterpene
meta-Cymene	4.33	1020	0.02	[0.24]	1126	2.35*	Monoterpene
Limonene	4.43*	1026	4.50	3.24	1145	2.58*	Monoterpene
β -Phellandrene	4.43*	1026	[4.50]	[3.24]	1145	2.58*	Monoterpene
para-Cymene	4.43*	1026	[4.50]	0.16	1216	3.47	Monoterpene
1,8-Cineole	4.47	1029	0.45	1.52	1151	2.66	Monoterp. ether
<i>cis</i> - β -Ocimene	4.62	1037	0.02	0.24	1193	3.16*	Monoterpene
<i>trans</i> - β -Ocimene	4.79	1047	0.02	0.02	1209	3.37	Monoterpene
γ -Terpinene	4.95	1056	0.23	[0.24]	1193	3.16*	Monoterpene
<i>P. mariana</i> biomarker	5.22	1072	0.03				Monoterp. alcohol
Isoterpinolene	5.33	1078	0.04	0.04	1223	3.57	Monoterpene
Terpinolene	5.40	1083	1.05	1.04	1228	3.64	Monoterpene
para-Cymenene	5.61*	1094	0.12	0.06	1380	5.84	Monoterpene
γ -Campholenal	5.61*	1094	[0.12]				Monoterp. aldehyde
Linalool	5.87†	1107	0.29	25.30	1518	8.73*	Monoterp. alcohol
Nonanal	5.90†	1109	[0.29]	0.01	1347	5.36	Monoterp. aldehyde
endo-Fenchol	6.17	1122	0.02	0.43	1521	8.83*	Monoterp. alcohol
α -Campholenal	6.27	1126	0.14				Monoterp. aldehyde
<i>trans</i> -Pinocarveol	6.52	1138	0.08	0.14	1577	10.60*	Monoterp. alcohol
Camphor	6.64	1143	0.11	0.09	1432	6.78	Monoterp. ketone
Camphene hydrate	6.84*	1153	0.49	0.41	1529	9.09	Monoterp. alcohol
Citronellal	6.84*	1153	[0.49]	0.07	1425	6.65	Monoterp. aldehyde
Isoborneol	7.06	1163	0.06	0.05	1599	11.32	Monoterp. alcohol
Pinocamphone	7.18	1168	0.05	0.05	1446	7.08	Monoterp. ketone
Borneol	7.33	1175	1.22	1.25	1628	12.67	Monoterp. alcohol

Terpinen-4-ol	7.46	1181	0.25	0.21	1538	9.36	Monoterp. alcohol
Cryptone	7.85	1199	0.03	[0.14]	1577	10.60*	Monoterp. ketone
α -Terpineol	8.00	1204	0.34	0.38	1634	12.91	Monoterp. alcohol
endo-Fenchyl acetate	8.30*	1212	0.41	0.31	1410	6.34	Sesquiterpene
Verbenone	8.30*	1212	[0.41]	0.27	1608	11.74*	Monoterp. ketone
Thymol methyl ether	8.93	1229	0.02	0.02	1532	9.18	Monoterp. ether
Citronellol	9.19	1236	0.11	0.10	1719	17.16	Monoterp. alcohol
Geraniol	10.06	1260	0.03	0.05	1796	21.83	Monoterp. alcohol
<i>cis</i> -Verbenyl acetate	10.64	1275	0.07				Monoterp. ester
Bornyl acetate	10.93*	1283	25.62	[25.30]	1518	8.73*	Monoterp. ester
Isobornyl acetate	10.93*	1283	[25.62]	0.34	1518	8.74*	Monoterp. ester
<i>trans</i> -Pinocarvyl acetate	11.28	1293	0.16	0.14	1544	9.56	Monoterp. ester
<i>P. mariana</i> biomarker	11.33	1294	0.14	0.16	1579	10.67	Monoterp. ester
α -Cubebene	13.24*	1330	0.13	0.02	1408	6.31	Sesquiterpene
exo-2-Hydroxycineole acetate	13.24*	1330	[0.13]				Monoterp. ester
α -Terpinyl acetate	13.84	1340	0.09	0.07	1630	12.72	Monoterp. ester
α -Ylangene	14.19	1346	0.03	0.01	1422	6.59	Monoterp. ester
Citronellyl acetate	14.40	1350	0.10	0.09	1612	11.89	Monoterp. ester
α -Copaene	14.61	1354	0.04	0.05	1429	6.72	Sesquiterpene
β -Elemene	15.71	1373	0.15	0.17	1525	8.95	Sesquiterpene
Longifolene	16.22*	1382	0.34	0.15	1486	7.88	Sesquiterpene
Geranyl acetate	16.22*	1382	[0.34]	0.19	1701	16.09	Monoterp. ester
β -Caryophyllene	17.05	1397	0.44	[0.43]	1521	8.83*	Sesquiterpene
<i>cis</i> -Muurolo-3,5-diene	19.15*	1425	0.09	0.07	1550	9.75	Sesquiterpene
<i>trans</i> -Muurolo-3,5-diene	19.15*	1425	[0.09]				Sesquiterpene
α -Humulene	19.49	1430	0.13	0.33	1582	10.76*	Sesquiterpene
<i>trans</i> -Cadin-1(6),4-diene	21.03	1450	0.12	[0.33]	1582	10.76*	Sesquiterpene
Germacrene D	21.49*	1456	0.57	0.40	1619	12.25	Sesquiterpene
γ -Muurolole	21.49*	1456	[0.57]	[0.27]	1608	11.74*	Sesquiterpene
Germacrene A	23.26	1480	0.04	0.06	1688	15.43	Sesquiterpene
α -Muurolole	23.40	1481	0.58	0.48	1641	13.28	Sesquiterpene
γ -Cadinene	24.33	1494	0.58	0.68	1665	14.37*	Sesquiterpene
δ -Cadinene	25.01*	1502	2.17	2.05	1673	14.74	Sesquiterpene
β -Bisabolene	25.01*	1502	[2.17]	[0.68]	1665	14.37*	Sesquiterpene
<i>trans</i> -Calamenene	25.31	1506	0.07	0.05	1733	18.01	Sesquiterpene
<i>trans</i> -Cadin-1,4-diene	25.97	1514	0.05	0.04	1695	15.76	Sesquiterpene
α -Cadinene	26.30	1518	0.13	0.13	1699	15.97	Sesquiterpene
<i>trans</i> - α -Bisabolene	27.42	1531	0.23	0.22	1705	16.29	Sesquiterpene
1,10-diepi-Cubenol	33.71	1610	0.05	0.06	1959	32.89	Sesquiterp. alcohol
Cubenol	34.48	1626	0.04	0.03	1957	32.75	Sesquiterp. alcohol
τ -Cadinol	34.90	1635	0.22	0.23	2075	37.94	Sesquiterp. alcohol
τ -Muurolole	35.04	1638	0.22	0.22	2089	38.45	Sesquiterp. alcohol
α -Muurolole	35.19	1641	0.07	0.06	2104	38.96	Sesquiterp. alcohol

α -Cadinol	35.57	1649	0.42	0.42	2131	39.70	Sesquiterp. alcohol
Oplopanone	38.97	1727	0.06	0.06	2358	45.24	Sesquiterp. alcohol
Manoyl oxide	45.77	1959	0.02	0.02	2191	41.34	Diterp. ether
<i>cis</i> -Abienol	49.76	2128	0.04	0.04	2670	51.43	Diterp. alcohol
Total identified			98.91%	98.02%			

*: 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 : Clear liquid

Refractive index : 1.4710 \pm 0.0003 (20 °C)

CONCLUSION

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



