

GC-MS Profiling Analysis Prepared for Jade Bloom, Inc

Date: April 25, 2018
Sample: Black Pepper
Type: Essential Oil
Source: *Piper nigrum*
Batch: 041879776

ANALYSIS SUMMARY

| Identification | DB-5 (%) | DB-WAX (%) | Classe |
|----------------------------------|----------|------------|------------------------|
| Ethanol | 0.05 | 0.05 | Aliphatic alcohol |
| Isovaleral | tr | tr* | Aliphatic aldehyde |
| 2-Methylbutyral | tr | [tr]* | Aliphatic aldehyde |
| Toluene | tr | tr | Simple phenolic |
| Tricyclene | 0.01 | 0.01 | Monoterpene |
| α -Thujene | 1.05 | 1.05 | Monoterpene |
| α -Pinene | 10.11 | 10.13 | Monoterpene |
| α -Fenchene | 0.28* | 0.01 | Monoterpene |
| Camphene | [0.28]* | 0.27 | Monoterpene |
| Sabinene | 17.74* | 8.44 | Monoterpene |
| β -Pinene | [17.74]* | 9.40 | Monoterpene |
| 6-Methyl-5-hepten-2-one | 0.01 | | Aliphatic ketone |
| Myrcene | 1.53 | 1.54 | Monoterpene |
| α -Phellandrene | 1.01* | 1.01 | Monoterpene |
| Pseudolimonene | [1.01]* | 0.03 | Monoterpene |
| Δ 3-Carene | 6.39 | 6.40 | Monoterpene |
| α -Terpinene | 0.14* | 0.14* | Monoterpene |
| 1,4-Cineole | [0.14]* | [0.14]* | Monoterpenic ether |
| ortho-Cymene | 0.01 | 0.35* | Simple phenolic |
| para-Cymene | 0.34 | [0.35]* | Monoterpene |
| β -Phellandrene | 14.03* | 1.42* | Monoterpene |
| 1,8-Cineole | [14.03]* | [1.42]* | Monoterpenic ether |
| Limonene | [14.03]* | 12.71 | Monoterpene |
| (Z)- β -Ocimene | 0.02 | 0.03 | Monoterpene |
| (E)- β -Ocimene | 0.18 | 0.19 | Monoterpene |
| Unknown | 0.01 | | Monoterpene |
| γ -Terpinene | 0.24 | 0.24 | Monoterpene |
| cis-Sabinene hydrate | 0.12 | 0.20 | Monoterpenic alcohol |
| Isoterpinolene | 0.07 | 0.08 | Monoterpene |
| Terpinolene | 0.33* | 0.32 | Monoterpene |
| para-Cymenene | [0.33]* | 0.01 | Monoterpene |
| trans-Sabinene hydrate | 0.09 | 0.08 | Monoterpenic alcohol |
| Unknown | 0.01 | tr | Unknown |
| Linalool | 0.40 | 0.40 | Monoterpenic alcohol |
| Verbenol analog? | tr | tr | Monoterpenic alcohol |
| trans-para-Mentha-2,8-dien-1-ol | 0.03 | 0.02 | Monoterpenic alcohol |
| cis-Limonene oxide | tr | tr | Monoterpenic ether |
| cis-para-Mentha-2,8-dien-1-ol | 0.02 | 0.03 | Monoterpenic alcohol |
| trans-para-Menth-2-en-1-ol | 0.02 | 0.02 | Monoterpenic alcohol |
| trans-Verbenol | 0.01 | 0.04* | Monoterpenic alcohol |
| 1,4-Dimethyl-4-acetylcyclohexene | 0.01 | 0.01 | Monoterpenic ketone |
| meta-Mentha-4,6-dien-8-ol | 0.01 | 1.28* | Monoterpenic alcohol |
| Pinocarvone | 0.02 | tr | Monoterpenic ketone |
| Borneol | tr | 0.51* | Monoterpenic alcohol |
| α -Phellandren-8-ol | 0.01 | 2.65* | Monoterpenic alcohol |
| Terpinen-4-ol | 0.48 | 0.47 | Monoterpenic alcohol |
| meta-Cymen-8-ol | 0.02 | 0.01 | Monoterpenic alcohol |
| Cryptone | 0.01 | 0.02 | Normonoterpenic ketone |

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|--------------------------------------|---------|----------|------------------------|
| para-Cymen-8-ol | tr | 0.01 | Monoterpenic alcohol |
| α -Terpineol | 0.10 | [0.51]* | Monoterpenic alcohol |
| Myrtenol | 0.02 | 0.01 | Monoterpenic alcohol |
| <i>trans</i> -Isopiperitenol | 0.01 | 0.11* | Monoterpenic alcohol |
| Verbenone | 0.02 | 0.09* | Monoterpenic ketone |
| Car-2-en-4-one? | 0.01 | [0.04]* | Monoterpenic ketone |
| <i>trans</i> -Carveol | 0.01 | tr | Monoterpenic alcohol |
| Nerol | 0.02 | 0.01 | Monoterpenic alcohol |
| <i>cis</i> -Carveol | tr | 0.01 | Monoterpenic alcohol |
| Cuminal | 0.01 | 0.04 | Monoterpenic aldehyde |
| Carvone | 0.01 | 0.32* | Monoterpenic ketone |
| Car-3-en-2-one | tr | [0.11]* | Monoterpenic ketone |
| Unknown | 0.02 | 0.02 | Unknown |
| Methyl citronellate | 0.01 | 0.03 | Monoterpenic ester |
| Bornyl acetate | 0.01 | 0.02 | Monoterpenic ester |
| Cuminol | 0.01 | 0.01 | Monoterpenic alcohol |
| Unknown | 0.01 | | Oxygenated monoterpene |
| Car-3-en-5-one | 0.02 | 0.01 | Monoterpenic ketone |
| Limonene hydroperoxide I | 0.02 | | Monoterpenic peroxide |
| Unknown | 0.01* | | Oxygenated monoterpene |
| Methyl geranate | [0.01]* | 0.01 | Monoterpenic ester |
| Bicycloelemene | 0.06* | 0.01 | Sesquiterpene |
| δ -Elemene isomer | [0.06]* | 0.01 | Sesquiterpene |
| δ -Elemene | 1.90 | 1.87 | Sesquiterpene |
| α -Cubebene | 0.22 | 0.21 | Sesquiterpene |
| Cyclosativene I | 0.09 | 0.07 | Sesquiterpene |
| α -Copaene | 3.60 | 3.57 | Sesquiterpene |
| <i>cis</i> - β -Elemene | 0.02 | | Sesquiterpene |
| β -Cubebene | 0.36 | 0.36 | Sesquiterpene |
| β -Elemene | 0.37 | 27.03* | Sesquiterpene |
| Isocaryophyllene | 0.02 | 0.03 | Sesquiterpene |
| α -Gurjunene | 0.12 | 0.10 | Sesquiterpene |
| β -Caryophyllene | 26.55 | [27.03]* | Sesquiterpene |
| β -Copaene | 0.18 | [27.03]* | Sesquiterpene |
| <i>trans</i> - α -Bergamotene | tr | [27.03]* | Sesquiterpene |
| α -Guaiane | 0.06 | [27.03]* | Sesquiterpene |
| Unknown | tr | | Unknown |
| α -Humulene | 1.31 | [1.28]* | Sesquiterpene |
| allo-Aromadendrene | tr | tr | Sesquiterpene |
| β -Santalene | 0.02 | 0.03* | Sesquiterpene |
| (<i>E</i>)- β -Farnesene | 0.23 | 0.22 | Sesquiterpene |
| γ -Gurjunene | 0.01 | [0.03]* | Sesquiterpene |
| γ -Murolene | 0.04 | 0.09* | Sesquiterpene |
| α -Amorphene | 0.10 | [0.09]* | Sesquiterpene |
| Germacrene D | 0.44 | [0.51]* | Sesquiterpene |
| β -Selinene | 0.30* | 0.30 | Sesquiterpene |
| ar-Curcumene | [0.30]* | 0.07 | Sesquiterpene |
| <i>trans</i> -Muurolo-4(15),5-diene | 0.06 | 0.26 | Sesquiterpene |
| Bicyclogermacrene | 0.80* | 0.44 | Sesquiterpene |
| α -Selinene | [0.80]* | 0.21 | Sesquiterpene |
| Viridiflorene | [0.80]* | [0.09]* | Sesquiterpene |
| epi-Cubebol | 0.09 | 0.15 | Sesquiterpenic alcohol |

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|--|---------------|---------------|--------------------------|
| α -Muurolene | 0.56 | [0.32]* | Sesquiterpene |
| Cubebol | 2.99* | 0.31 | Sesquiterpenic alcohol |
| β -Bisabolene | [2.99]* | [2.65]* | Sesquiterpene |
| 7-epi- α -Selinene | 0.10 | 1.46* | Sesquiterpene |
| δ -Cadinene | 1.57* | [1.46]* | Sesquiterpene |
| <i>trans</i> -Calamenene | [1.57]* | 0.09 | Sesquiterpene |
| (<i>E</i>)- γ -Bisabolene | 0.06 | 0.07 | Sesquiterpene |
| α -Cadinene | 0.01 | tr | Sesquiterpene |
| α -Calacorene | 0.01 | 0.04* | Sesquiterpene |
| (<i>E</i>)- α -Bisabolene | 0.06 | 0.06 | Sesquiterpene |
| α -Elemol | 0.07* | 0.01 | Sesquiterpenic alcohol |
| Isocaryophyllene epoxide B | [0.07]* | [0.04]* | Sesquiterpenic ether |
| Unknown | 0.05 | | Aliphatic alcohol |
| (<i>E</i>)-Nerolidol | 0.08 | 0.09 | Sesquiterpenic alcohol |
| Spathulenol | 0.08 | 0.06 | Sesquiterpenic alcohol |
| Caryophyllene oxide | 0.60* | 0.48 | Sesquiterpenic ether |
| Caryophyllene oxide isomer | [0.60]* | 0.11 | Sesquiterpenic ether |
| Unknown | 0.01 | 0.01 | Oxygenated sesquiterpene |
| Humulene epoxide I | 0.02 | 0.01 | Sesquiterpenic ether |
| Humulene epoxide II | 0.03 | 0.12 | Sesquiterpenic ether |
| α -Corocalene | 0.02 | 0.03 | Sesquiterpene |
| Guaia-6,10(14)-dien-4 β -ol | 0.22* | 0.21 | Sesquiterpenic alcohol |
| Caryophylladienol I | [0.22]* | 0.01 | Sesquiterpenic alcohol |
| Caryophylladienol II | 0.02 | 0.03 | Sesquiterpenic alcohol |
| τ -Cadinol | 0.06* | tr | Sesquiterpenic alcohol |
| τ -Muurolol | [0.06]* | 0.05 | Sesquiterpenic alcohol |
| α -Muurolol | 0.21 | 0.21 | Sesquiterpenic alcohol |
| <i>cis</i> -Calamenen-10-ol | 0.01 | 0.02 | Sesquiterpenic alcohol |
| <i>trans</i> -Calamenen-10-ol | 0.02 | 0.02 | Sesquiterpenic alcohol |
| (3 <i>Z</i>)-Caryophylla-3,8(13)-dien-5 β -ol | 0.01 | 0.01 | Sesquiterpenic alcohol |
| Unknown | 0.02 | | Oxygenated sesquiterpene |
| α -Bisabolol | 0.01 | 0.01 | Sesquiterpenic alcohol |
| Unknown | 0.02 | tr | Oxygenated sesquiterpene |
| Total identified | 98.86% | 98.81% | |

*: Two or more compounds are coeluting on this column

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

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

Note: no correction factor was applied

PHYSICOCHEMICAL DATA

Physical aspect: Clear liquid

Refractive index: 1.4825 \pm 0.0003 (20 °C)

COMPLIANCE WITH ISO 3061:2008 (PIPER NIGRUM, INDIA)

| Compound | Min. Content | Max. Content | Observed Content | Complies? |
|------------------------|--------------|--------------|------------------|-----------|
| α -Pinene | 3 | 12 | 10.1 | Yes |
| β -Pinene | 5 | 12 | 9.4 | Yes |
| Sabinene | 6 | 15 | 8.4 | Yes |
| Δ^3 -Carene | 3 | 15 | 6.4 | Yes |
| Limonene | 10 | 17 | 12.7 | Yes |
| δ -Elemene | 0.5 | 3.5 | 1.9 | Yes |
| α -Copaene | 0.5 | 4.5 | 3.6 | Yes |
| β -Caryophyllene | 12 | 29 | 26.6 | Yes |
| Germacrene D | | 2 | 0.4 | Yes |
| α -Selinene | | 3 | 0.2 | Yes |
| β -Selinene | 0.5 | 3.5 | 0.3 | No |
| Caryophyllene oxide | | 1 | 0.5 | Yes |
| Refractive index | 1.478 | 1.487 | 1.4825 | Yes |

CONCLUSION

No adulterant, contaminant or diluent has been detected using this method. The oil marginally does not comply with the ISO standard for Indian black pepper oil.