

AGARWOOD-BASED ORNAMENTS

AGARWOOD IMPREGNATED ORNAMENTS

Agarwood oil can be used as an impregnating agent to make aromatic bead strings, ornamental statues and wood carvings, prayer rugs, shrouds and burial materials,...



INDUCEMENT TECHNIQUES

Newly created scientific achievements have shown that Agarwood formation can occur in cultivated trees as young as three years of age by using inducement (or wounding/pathological) technique. After wounding, that is drilling in tree-trunk, we put into drillhole a bio-agent consisting of special fungi and biochemicals. A sequential change in the wood coloration was observed around injury sites. One or two months after wounding a pale discoloration occurred, followed by a darker yellow-brown discoloration after 4 months, becoming dark brown within 10-18 months and changing to black within 24 months with accompanied on burning scent. Accurate estimation of the yield and quality of such Agarwood is still a pending question due to existence of unknown and mystic factors.



Major constituents of inducement bio-agent are: botanic chemicals (for example: Methyl jasmonate, Jasmonic acid,...) that enhance self-defence ability of tree against fungal parasitization and isolated fungi (for instance: *Cytosphaera Manganiferae*, *Epicoecium granulatum*, *Aspergillus Phoenicis*, *Penicillium Citrinum*, *Fusarium bulbiferum*, *Fusarium laterum*, *Fusarium oxysporum*, *Fusarium solani*,...)



AGARWOOD

TRÂM HƯƠNG

沉香

กฤษณาน้อย

BIODIVERSITY CONSERVATION & POVERTY ALLEVIATION IN VIETNAM



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AGARWOOD & AQUILARIA CRASSNA TREE:



The genus *Aquilaria* Lamk. (family-Thymelaeaceae, order-Thymelales) comprises about 28 species that can possibly give Agarwood, an extremely precious resinous wood formed in heartwood of *Aquilaria* tree. The species *Aquilaria crassna* Pierre ex Lecomte is the most valuable among 6 *Aquilaria* species that are available in Vietnam and distributed mainly in the mountainous regions of Ho Tinh, Khanh Hoa, Quang Nam,...(except *Gyrinops* species which can probably create Agarwood). There are now in Vietnam about 15,000,000 *Aquilaria* trees of 2 years and upwards.

Some wild trees become randomly infected with some parasite fungi, bacteria or molds and begin to produce Agarwood in heartwood due to immune response to this attack. But this biologic process develops very, very slowly over several tens of years. Not all *Aquilaria* trees produce agarwood, only approximately 10% of wild mature *Aquilaria* tree can naturally create this resin. Other mystical factors may also play an important role in Agarwood formation.



GRADATION OF AGARWOOD

- GRADE I: Black, heavier than water
- GRADE II: Black wood streaked with brown
- GRADE III: Brown wood intercalated with yellow streaks
- GRADE IV: Brownish wood streaked with black resin
- GRADE V: Yellow wood streaked with brown
- GRADE VI: Light yellow wood streaked with brownish wood

AGARWOOD OILS, ATTARS, PERFUMES

AGARWOOD OILS

Agarwood oils are made of from resinous wood of *Aquilaria crassna*, *A. malaccensis*, *A. sinensis*, *A. filaria*,... by distillation or extraction techniques. Agarwood oils can be used for making agarwood-based perfumes & attars.

Applications: perfumery & cosmetic industry, aromatherapy & ayurvedic medicine, body care & metaphysical practices, religious worship, impregnating substances for ornaments,...



PHYSICAL PARAMETERS

- Appearance: lightly yellow to brownish liquid
- Odour: sweet aromatic scent
- Specific gravity (@25°C): 0.89 – 1.08 g/cm³
- Refractive index (@20°C): 1.4910 – 1.6090
- Optical Rotation (@20°C): -13.2° – -17.8°
- Acid value: 6.8 – 13.2
- Ester value: 18.3 – 27.1
- Ester value (after acetylation): 104.9 – 120.6
- Solubility: soluble in alcohol



MAIN CONSTITUENTS (GCMS DATA)

Sesquiterpenes: ♣ Agarospirol (Hinesol) ♣ Gamma-Eudesmol ♣ Jinkohol ♣ Jinkohol II ♣ Jinkaheremol ♣ Kusunal ♣ Alpha-Agrofuran ♣ Guaiol (Champacal) ♣ Nootkatone ♣ Elemene ♣ Humulene ♣....

Phenylethyl chromones: ♣ 2-(2-Phenylethyl)chromone ♣ 6-Methoxy-2-(2-phenylethyl) chromone ♣ 6,7-Dimethoxy-2-(2-phenylethyl)chromone ♣ 7,8-dimethoxy-2-[2-(3'-acetoxyphenyl)ethyl]chromone ♣ 5,8-dihydroxy-2-phenethyl-chromen-4-one ♣....

Others: ♣ Alpha-selinene ♣ Beta-Eudesmene ♣ Gamma-Selinene ♣ Alpha-Gurjunene ♣ Gamma-Gurjunene ♣ Pentadecenoic acid ♣ Octanoic acid ♣ Enanthylic acid ♣ Valencene ♣ Dibenzylacetone ♣ Acetophenone ♣....



AGARWOOD INCENSES

AGARWOOD INCENSES

Incense is a substance whose pleasing aroma is released by burning and has a form of stick, coil, cone or block. Incense ingredients come from the aromatic portion of plants (bark, wood, leaves, flowers, resin, roots,...) whenever the aroma is concentrated. Incense binder is used as a suitable glue in incense making.

Applications: religious worship, aromatherapy & ayurvedic medicine, air freshener, dhyaana meditation,...



INGREDIENTS

- Five basic ingredients connotes The Five Elements in East Asian philosophy:
 - *Illicium verum* Hooker fil. (Star anise), connotes Metal
 - *Pogostemon cablin* Blanco Benth. (Patchouli), connotes Wood
 - Agarwood (Oud, Aloeswood), connotes Water
 - *Syzygium aromaticum* L. Merr. et Perry (Cloves), connotes Fire
 - *Vetiver zizanioides* L. Nash (Vetiver) connotes Earth

Other aromatic ingredients:

- *Myristica fragrans* Houtt (Nutmeg)
- *Amomum aromaticum* Roxb. (Bengal cardamom)
- *Santalum album* L. (Sandalwood)
- *Aglaia odorata* Lour (Ngau)
- *Asarum sieboldii* Miq. (Teton)
- *Cinnamomum cassia* Blume (Cassia)
- *Dianella odorata* Lamk. (Huongbai)
- *Biota orientalis* L. Endl. (Oriental arbor)

BINDERS

- *Litsea glutinosa* Lour. C.B.Rob. (Tallow laurel)
- *Pouzolzia sanguinea* Bl. Merr. (*Pouzolzia viminea*)

