

Sandalwood oils

1. Introduction:

Sandalwood oil, distilled from the heart wood and roots of the sandalwood tree, is one of the most valuable essential oils, valued by perfumers for its woody notes, providing a deep rich base note to perfumes and acting as a natural fixative. In addition to acting as a feed stock for the production of the essential oil, the wood is also valued for carving, and furniture making. Rising demand and very high prices for both wood and essential oil, a slow growing tree which takes 30 to 60 years to give a crop, a destructive harvest to get at the roots and heartwood with no sustainable harvesting options, and the scene is set for uncontrolled and illegal harvesting and destruction of the natural resource. 40 years ago sandalwood oil was under US\$100/kg; now it is over US\$2,000/kg reflecting the constraint to supply.

2. Sources:

Sandalwood oils come from a range of species, and while they all have similar uses, quality and characteristics vary between the oils of the different species. The key species used for distillation of essential oils are listed below, with East Indian Sandalwood oil and Australian Sandalwood oil dominating supplies to the market:

- East Indian Sandalwood oil (*Santalum album*). The most well known and oldest traded type of sandalwood, in use for thousands of years. Cultivation centered in India (it is native to the highlands of southern India and the Malayan Archipelago) with the center of production in India in Mysore. Its natural distribution extends down to Indonesia (particularly Timor), and it has been introduced into Australia and plantations established in the tropical northwestern areas – an estimated 8,000 ha with annual additions of around 1,000 ha; more recently it has also been introduced into a number of the S Pacific Islands and plantations established (Fiji, Tonga, Vanuatu, New Caledonia);
- Australian Sandalwood oil (*Santalum spicatum*, syn. *Eucarya spicata*). (Also referred to as West Australian Sandalwood oil). Native to the desert-like areas of SW Australia, close to Perth. Substantial plantations have also now been established – around 15,000 ha with annual additions of 1-2,000 ha. A second sandalwood species, *S. lanceolatum*, is also found in Australia, principally in Queensland, NSW, and northwestern part of Western Australia, but is little used commercially.
- *Santalum paniculatum*. Only found in Hawaii. Around 7,000 ha reported to be under sustainable management. Commercial oil now coming onto the market.
- *Santalum yasi*. Found in Fiji, Samoa and Tonga. Traditionally included in mixed cropping agroforestry cultivation systems. The species hybridizes readily with *S. album* resulting in variable quality of oil depending on the source trees.

- *Santalum austrocaledonicum*. Found in Indonesia, Papua New Guinea, New Caledonia.

African sandalwood oil, *Osyris lanceolata*, is in the same *Santalaceae* family and used in the same way in perfumery (also known as osyris oil). The tree is found through East and Southern Africa, typically on the dry boundary areas of forests, but rarely in large stands, and at the last CITES meeting its status and the impact of trade was placed on review.

West Indian Sandalwood, *Amyris balsamifera*, from the family *Rutaceae*, found in Central American and the Caribbean Islands, has no relationship with East Indian Sandalwood or the other sandalwood oils.

3. Distillation:

Heartwood and roots are chipped and pulverized to a coarse grind before distillation. Oil yield varies with the plant part, the age of the tree and the environment of cultivation. Roots can give up to 10% oil; heartwood up to 4%. Distillation takes 48 to 72 hours, and effectively ends when the yield of oil ceases to be economical. High pressure steam distillation will give a higher yield and reduced distillation time but will lose some of the delicate notes.

4. Quality Standards:

(a) East Indian Sandalwood oil (ISO 3518:2002; NF T 75-339)

Aspect: limpid liquid, somewhat viscous
 Colour: almost clear to yellow
 Odour: heavy, sweet and very lasting odour

Physical characteristics:

Density: 0.968 to 0.983 @ 20°C

Refractive index @ 20°C: 1.503 to 1.508

Optical rotation @ 20°C: -15 to -21°

Solubility in 70% ethanol (v/v) @ 20°C: less than 5 volumes of 70% ethanol for 1 volume of oil

Chemical characteristics:

Ester number: max 10

Total alcohol content, calculated as santalol: 90% minimum

(b) Australian Sandalwood oil (NF T 75-248)

Aspect: limpid liquid, somewhat viscous
 Colour: colourless to light yellow
 Odour: strong lasting characteristic odour of the wood

Physical characteristics:

Density: 0.968 to 0.978 @ 20°C

Refractive index @ 20°C: 1.504 to 1.510
Optical rotation@ 20°C : -8 to -3°
Solubility in 70% ethanol (v/v) @ 20°C : less than 5 volumes of 70% ethanol for 1 volume of oil

Chemical characteristics:

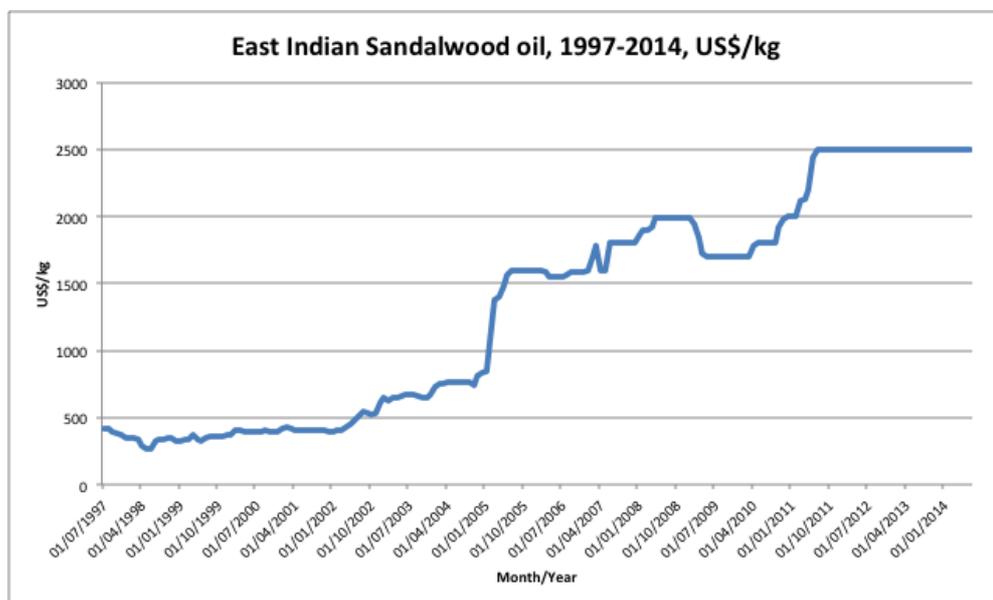
Acid number: maximum 5

Ester number: minimum 4.5; maximum 10

Ester number after acetylation: minimum 199

Total alcohol content, calculated as santalol not stated, but should be 90% minimum.

5. Prices:



Source: Public Ledger