

# Review of the data in Indian sandalwood *santalum album L.*

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## Abstract

A priceless tree connected to Hindu culture is sandalwood (*Santalum album L.*). It is the world's second-most costly wood. One of the best natural materials for carving, the tree's heartwood is prized for its scent. Pharmaceuticals, cosmetics, aromatherapy, and cologne all include sandalwood oil. Due to severe exploitation brought on by the governments of Kerala, Tamil Nadu, and Karnataka having a monopoly on the trade in sandalwood, *S. album* has been placed on the IUCN Red List under the vulnerable category. Sandalwood has significant genetic variation for various properties, according to extensive studies. Unfortunately, there is little information available regarding the heartwood and oil content, mostly due to the lack of sandalwood plantations. It is challenging to do additional research on these two crucial characteristics because wild populations are quickly declining. We fervently advocate that it is crucial to promote the construction of community- or corporation-owned sandalwood plantations in various regions of India with the proper incentives and safety precautions. These plants can serve as the foundational population sources for India to reclaim its preeminence in the valuable carving and perfumery industries using sandalwood.

Keyword : fruit and seed, use true sandalwood, distillation, production

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## Introduction

A small to medium-sized hemiparasitic tree known as white sandalwood (English), safed chandan (Hindi), sandal safaid (Urdu), etc., *Santalum album* Linn. [Family: Santalaceae]. The second most expensive wood in the world comes from one of the most costly trees. The significance of sandalwood in Hindu mythology is enormous. In accordance with the Vamana Purana, the wood is suggested for Shiva worship. The sandalwood tree is thought to be home to the goddess Lakshmi. Along with Aloe wood and cloves, it is one of the three incenses in Buddhism that are regarded as essential to Buddhist practise. Sandalwood was introduced by the ancient Egyptians, who used it for ritual burnings, medicine, and embalming the dead.

Numerous products, including soaps, detergents, creams, lotions, perfumes, etc., employ sandalwood as a scent element. It is also used in many food goods as a flavour agent.

Since antiquity, the Unani medical system has made extensive use of sandalwood and its oil. Pedanius Dioscorides was a Greek physician and botanist who flourished in the first century AD. He wrote *De Materia Medica*, a Greek encyclopaedia on medicinal plants that served as the foundation for all modern pharmacopoeias.

The longstanding and widespread use of this species is the basis for the genus' naming and classification. Its ultimate etymological source is the Sanskrit word Chandana (andana), which means "wood for burning incense" and is related to the words candrah, "shining, glowing," and candere, to shine or glow. Around the 14<sup>th</sup> or 15<sup>th</sup> century, it reached English through Late Greek, Medieval Latin, and Old French. [1] Northern Australia, the Malay

Archipelago, and the tropical zone of peninsular India are the native home of the sandalwood. [2] [3] The Timor and Sumba islands of Indonesia and the drier tropical parts of India host the majority of the population. [4] [5]

#### Vernacular Name

English: Sandal tree, white sandal

Hindi: Safed chandan, santal

Kannada: Bavanna, srigandadamara, agarugandha

Malayalam: Candanam

Sanskrit: Candanah, srikhandam

Tamil: Andanam

Telugu: Candanamu, gandhapucekka, srigandapumanu, Tellagandhapucettu.

Unani: Sandal-e-safaid (Khare, 2007)

#### Fruit and seed

The primary components of the polyunsaturated fatty oil (seed oil) found in the seeds of trees in the genus *Santalum* are acetylenic glycerides—santalbic or ximenynic acid and stearolic acid

All Santalaceae seeds contain ximenynic acid, which is regarded as a defining trait of this family (Hatt & Schoemfeld 1956, Liu et al. 1996). Researchers have discovered that Indian sandalwood (*Santalum album*) seeds had the greatest concentration of ximenynic acid, at 79.0-82.8%. (Hopkins & Chisholm 1969, Butaud et al. 2008).

In compared to ximenynic acid, *Santalum album* seeds contain less oleic and palmitic acid, 12.3-18.0% and 0.8%, respectively (Fig. 1). Some species of the *Santalum* genus, such as *Santalum acuminatum* A.DC., *Santalum spicatum* (R.Br.) A.DC., and *Santalum murrayanum* C.A.Gardner, have seeds that are richer in oleic acid, with contents ranging from 43.8 to 58.7% (Hopkins & Chisholm 1969, Rivett et al. 1985, Liu et al. 1997,

Native Australians consume the fruit, nuts, and seed kernels of nearby sandalwood trees like the quandong (*S. acuminatum*). Early European settlers in Australia utilised quandong to make jams, pies, and chutneys from the fruit as well as to cook damper by infusing it with the leaves. [26] In Scandinavia, anchovies and some varieties of pickled herring, such as matjes, sprat, and some types of traditional spegesild, are marinated with pulverised bark from red sandalwood (*Pterocarpus soyauxii*), along with other tropical spices, to produce a reddish colour and slightly perfumed flavour. [6] [7] [8]

Modern chefs have started experimenting with using the nut as a bush food alternative for macadamia nuts or an almond, hazelnut, and other nut substitute in Southeast Asian-inspired cuisine.

[9]

#### Bark and leaves

Major tannins (14%), fatty acids, and trace levels of betasitosterol, a triterpene ester, are present in the bark of sandalwood trees (Shankaranarayana et al. 1980a, b). A triterpene ester with chemosterilant and insect growth inhibitory effects is urs-12-en-3-beta-yl-palmitate (0.3%). (Shankaranarayana et al. 1979). Several flavonoids were extracted and described from the leaves of *Santalum album*, including vitexin, isovitexin, orientin, isorientin, chrysin-8-C-D-glucopyranoside, and isorhamnetin (Yan et al. 2011, 2013).

#### Usage

- In cosmetics, red sandalwood is frequently used. Red sandalwood extract is used to lighten the skin and minimise skin scarring. Moreover, it possesses anti-aging qualities.
- Red sandalwood can be used to minimise or get rid of facial or skin wrinkles. It contains anti-aging and cleansing qualities. Red sandalwood, rose water, and glycerine can be used to make a face pack that will leave your skin wrinkle-free.

- The astringent qualities of red sandalwood oil are present. The gums are strengthened, and tooth damage is prevented.
- The wood is applied to the scalp as a rubdown. Moreover, it is used to lessen rashes, edoema, and joint pain.
- Red sandalwood leaves' juice has antibacterial and anthelmintic properties. Mostly, it is utilised to clean wounds.

### True sandalwood

Medium-sized hemiparasitic trees known as sandalwoods are related to European mistletoe in a botanical sense. Northern Australia, the Malay Archipelago, and the tropical zone of peninsular India are native home of sandalwood. [10] [11] The Timor and Sumba Islands of Indonesia and the drier tropical parts of India host the majority of the population. [12] Up to the sixteenth century CE, it extended to other areas via the Incense Trade Route, which was supported by extensive Indian and Arab mercantile networks as well as Chinese maritime trading channels. [13] During the Incense Trade Route, the majority of East Asia and West Asia's consumption was supported by the sandalwood from peninsular India and the Malay Archipelago. [14] [15]

Southeast Asia and Southern India are the native habitats of the endangered species *S. album*. The Timor and Sumba islands of Indonesia and the drier tropical parts of India host the majority of the population. [16] The majority of Karnataka and the neighbouring districts of Maharashtra, Tamil Nadu, Kerala, and Andhra Pradesh are the main sandal-growing regions in India. [17] Although sandalwood trees are owned by the governments of India, Pakistan, and Nepal, and their collection is regulated, many trees are unlawfully cut down. Recently, the cost of sandalwood oil increased to \$3000 per litre. [18]

Additionally used and regarded as high quality was the Hawaiian sandalwood (*iliahi*), *S. ellipticum*, *S. freycinetianum*, and *S. paniculatum*. Between 1790 and 1825, these three species were utilised until the supply of trees ran out (a fourth species, *S. haleakalae*, occurs only in subalpine areas and was never exported). Despite the fact that *S. freycinetianum*, *S. paniculatum*, and *S. ellipticum* are still uncommon, they have not recovered their former levels of abundance or size. [19] [20]

### Distillation

Sandalwood is used to make oil by distillation. There are numerous techniques employed, including as solvent extractions, CO<sub>2</sub> extraction, steam distillation, and water distillation. The most popular technique employed by sandalwood businesses is steam distillation. Boiling, steaming, condensation, and separation are all steps of a four-step process that results in the reaction. (60-100 °C or 140-212 °F) Water is heated to high temperatures before being pumped through the wood. Although the oil is very firmly bonded inside the wood's cellular structure, the intense heat of the steam can cause the oil to be liberated. The steam and oil mixture is then cooled and separated, allowing the essential oil to be extracted. This procedure takes 14 to 36 hours to complete, taking significantly longer than the distillation of any other essential oil, but often results in oil of much higher quality. The more conventional method of extracting sandalwood involves soaking the wood in water and then boiling it to release the oil. This process is called water, or hydro, distillation. [21] Due of the significant expenses and time required to heat a big amount of water, this method is no longer as popular. [22]

### Production

Indian sandalwood (*S. album*) trees must be at least 15 years old to produce commercially useful sandalwood with high quantities of fragrant oils; the output, quality, and volume are still unknown. Age and position of the tree have a tendency to affect the oil yield; typically, older trees produce oil with the highest content and quality. Australia is the world's largest producer of *S. album*, with the majority being grown by Quintis (formerly Tropical Forestry Services), which in 2017 controlled about 80% of the world's supply of Indian sandalwood and Santanol, in the

region surrounding Kununurra in the state's far north. [23] Australia has surpassed India as the world's largest producer in the twenty-first century. The reduction is partially attributable to overexploitation. [24] [25]

In Western Australia's wheatbelt, Australian sandalwood (*S. spicatum*) is grown in industrial plantations and has been a significant contributor to the local economy since colonial times. In 2020, WA will have the world's greatest plantation resource. [26]

The majority of Australian sandalwood is harvested and sold as logs that have been assessed for heartwood content. The white sapwood does not need to be removed before distilling the oil, making this species unusual. The logs are either ground into powder for incense production or processed to extract the essential oil. The sapwood of Indian sandalwood, which is primarily used for oil extraction, must be removed before distillation. Australian sandalwood oil costs about US\$1,500 per kilogramme (2.2 lb) as of 2020, but Indian sandalwood oil costs about US\$2,500 per kg due to its greater alpha santalol content. [27]

Together with African blackwood, pink ivory, agarwood, and ebony, sandalwood is frequently listed as one of the most costly woods in the world. [28] [29]

Mental alertness is a benefit of sandalwood. According to preliminary studies, healthy adults' mental alertness or attention is not increased by inhaling the scent of white sandalwood oil for 20 minutes or by applying it to their skin.

- Urine tract infections (UTIs).
- Cold prevalent.
- Cough.
- Bronchitis.
- Feelings of febrility.
- Mouth and throat discomfort.
- A headache.
- The heat stroke.
- Gallbladder and liver issues.
- Additional condition

## Conclusion

Since ancient times, sandalwood and its oil have been used for scent as well as the treatment of numerous illnesses. It is said to have anti-inflammatory, diuretic, cardiotoxic, exhilarating, nervine tonic, expectorant, gastroprotective, and diuretic qualities. As a result, it helps treat disorders of the integument, cutaneous, respiratory, gastrointestinal, cardiovascular, and locomotor systems. Its antibacterial, antiviral, analgesic, anti-inflammatory, antioxidant, sedative, anticancer, and effects on the cardiovascular and gastrointestinal systems are all pharmacologically supported. The numerous pharmacological effects of sandalwood and its oil are so well supported by this review. Moreover, clinical studies are advised to demonstrate the pharmacological activity listed above in a variety of illnesses.

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