



An overview on Indian Sandalwood (*Santalum album L.*)

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Abstract:

A priceless tree connected to Indian culture is sandalwood (*Santalum album L.*). The second-most costly plant in the world is this one. Sanskrit names for sandalwood include Chandana and East Indian Sandalwood. Its essential oil is also known as East Indian Sandalwood Oil. The species is hemiparasitic and capable of photosynthesizing, but it depends on the host plant for its water, mineral nutrition, and organic material needs. From the newborn through the cremation, sandalwood is employed according to Indian tradition. Sandalwood oil and trees have a very significant commercial value on the Indian market. There are several different types of sandalwood, and they are all widely available.

The perfume of the tree's heartwood makes it prized. Pharmaceuticals, aromatherapy, cosmetics, and perfumes all use sandalwood oil. An evergreen tree native to India, sandalwood is utilised in a variety of industrial items, including mouthwash, delicacies, incense, room fresheners, deodorants, soaps, lotions, and creams. Sandal oil and paste are also used in medical treatments, skin care products, and cosmetics. It has some truly amazing medical qualities. The oil, which can be extracted with water or alcohol or squeezed from the wood, has the medicinal characteristics. Sandalols and sandalols are the aromatic components of sandalwood oil. The properties of sandal wood essential oil, such as antiseptic, anti-inflammatory, anti-phlogistic, anti-spasmodic, astringent, cicatrizing, diuretic, disinfectant, emollient, expectorant, hypotensive, memory-enhancing, sedative, anti bacterial, anti-viral, and insect repellent, are what give it its health benefits.

KEYWORDS : sandalols; hemiparasitic; globose;Tylosis;antiscabietic;antiremorogenic;

Introduction:

Santalum album L., often known as Indian Sandalwood, is a small to medium-sized, evergreen, semi parasitic tree in the Santalaceae family. It is one of the oldest and most valuable sources of natural smell and has significant medical and commercial value. 3-5 It is the species known for its scent and important social and economic values. The term "sandal" Sandanam in Tamil, Chandanam in Telugu, Srigandha, Gandha in Kannada. Reviewing the past reveals that sandalwood has been mentioned throughout Indian folklore, ancient texts, and mythology. generally speaking As the sandal's history of recorded occurrence stretches back to, it is widely acknowledged that peninsular India is its native land. a minimum of 2500 years. historical analysis demonstrates that the term "sandalwood" appears in Indian mythology, both folklore and historic texts. Some civilizations attach significant importance to its aromatic and therapeutic properties, qualities. Its primary ingredient is "Santalol," which comes in two isomeric forms: santalol (41–55%) and santalol (16–24%), both of which are volatile substances with a distinct scent and are the main active ingredients. components. -Santalol has shown promise as a chemopreventive agent for UVB-induced skin damage. The emergence of tumours in mice, while -santalol's antiviral efficacy against influenza was being researched H3N2 virus A/HK in MDCK cells. Purified -santalol and -santalol were also capable of reduce the release of important cytokine-related substances including the pro-inflammatory arachidonic acid metabolite synthesis in skin cells. Twenty-six cytokines and chemokines were released in response to lipopolysaccharides. which were significantly reduced by exposure to either of the two sandalwood compounds simultaneously. Ibuprofen and other chemicals.

In a research involving a group of radiation patients, sandalwood and based lotion worked well to stop dermatitis brought by radiation. The majority of the harm is mediated by indirect effects, in which the production of free radicals brought on by the radiolysis of water results in macromolecules as DNA, proteins, and lipids are harmed. SO displayed insecticidal performance with LD50 values (g/fly) against male and female drosophila flies were 2.18 and 5.61, respectively. In vivo The ability of subcutaneously delivered drugs to fight plasmodial infection was proven by research employing a mouse model. oil from sandalwood It also works well as a spider mite deterrent. Additional small molecules are derivative products like the traces of santalene, curcumene, and cyclo-santalal aldehydes, as well as bergamotene. Historically, sandalwood oil was used to treat a variety of ailments, including dysentery, acne, and skin conditions. of other circumstances. Its oil is revered in traditional Chinese medicine as a potent analgesic. cooling, calming, and cleansing the blood help to reduce irritation and inflammation. The therapeutic qualities of Sandalwood can be found in the oil, which can be produced by pressing the wood, using alcohol extraction, or both. Fever, thirst, burning, and sweating are all reduced by it. It is beneficial for fever or restores the skin to its natural state after being damaged by excessive sun exposure, and it wakes the intellect. In addition to these, it is utilised in chayvanprasha, anti-dandruff shampoo, anti-wrinkle cream, infant cream, and anti-wrinkle powder. Sandalwood's heartwood is often utilised to create ornamental furniture and wood crafts. According to some reports, Sandal seed oil and zinc chloride can combine to produce a dark plastic solid that, when dissolved in benzene, makes the perfect base for insulation tapes. The weight of a sandalwood tree's heartwood and the amount and type of oil it contains both play a significant role in determining the tree's worth. Finding the sandalwood tree's heartwood development rate is crucial since it will have a big impact on how long the tree will be in production. The size of the tree is a constant factor in the heartwood's weight.

Morphology of sandalwood:

Santalum album is a little evergreen tree that reaches a height of 4 m in Australia, but it can reach a height of 20 m and a diameter of up to 2.4 m with slender branchlets in India. In ancient trees, the bark is hard with large vertical fractures and is tight, dark brown, reddish, dark grey, or practically black. The stalks are grooved, 5-15 cm long, and the leaves are thin, typically opposite, oblong or ovate elliptic, 3-8 x 3-5 cm, glabrous and sparkling green above, glaucous and slightly paler beneath. Flowers are straw-colored, tiny, and purplish-brown scarlet, green, or violet, up to 6 in small terminal or axillary clusters, 4-6 mm long, and odourless in terminal or axillary paniculate cymes. The ovary is unilocular and semi-inferior. The tree begins to bloom at a young age of two to three years. Usually from March to May and September to December, trees bloom twice a year.



figure.1



figure.2

The two flushes of bloom production can occasionally cross over one another, allowing the same tree to display all stages of growth from flower commencement to ripe fruits simultaneously. Fruit is a globose, fleshy drupe that has one seed and is crimson, purple, or black when ripe. It has a firm, ribbed endocarp and is capped with a scar. Seeds are bare and lacking Dry testa are placed in polybags or gunny bags for storage. Birds that feed on the outside fleshy pericarp disperse the species quickly through seed dissemination. The age of the tree at which viable seed production begins is five years.

Scientific classification:

Phylum: Spermatophyta

Sub Phylum: Angiospermae

Class : Magnoliopsida

Order : Santalales

Family : Santalaceae

Genus : Santalum

Species: album

Botanical name: Santalum album Linn.

Species and varieties:

- ❖ S.album L
- ❖ S.austrocaledonicumViell
- ❖ S.boninense (Nakai) Tuyama
- ❖ S.lanceolatum R.Br.
- ❖ S.macgregoriiF.Muell
- ❖ S.obtusifolium R.Br.
- ❖ S.insulareBertero
- ❖ S.acuminatum (R.Br. A.D.C.)
- ❖ S.murrayanum (T.Mitch) C.A.Gardner
- ❖ S.freycinetianumGaudich
- ❖ S.haleakale. Hillebr
- ❖ S.paniculatumHook&AM.
- ❖ S. fernaandezianumF.Phil.
- ❖ S.spicatum (R.Br.) A.D.C.

Geographical occurrence:

Australia, Indonesia, India
 New Caledonia, Vanuatu
 Bonin Islands
 Australia
 Papua New Guinea
 Fiji, Tonga
 Australia
 Australia
 Australia

Harvesting and Cultivation:


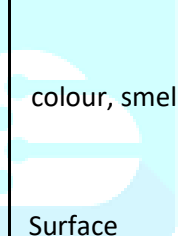
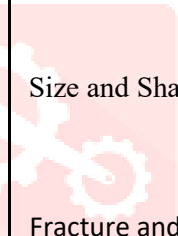

The major method of growing sandalwood trees is through exposing the seeds. The seeds of cleaned, sun-dried, and prepared seeds are then planted on nursery beds. Two different sandalwood trees are harvested from August to March when they are 15 to 20 years old. For the display of sandalwood seeds, the nursery has seed beds, including elevated and sunken beds. A seedling grows up to 30 to 35 cm on nursery beds after 7 to 8 months, at which point it is prepared for the move to the primary field. The pit is 45x45x45 cm in size and is dug for the planting of sandalwood seedlings. It is kept at a 10-foot space between plants.

After 30 years from planting, the sandalwood tree develops well and reaches maturity, making it suitable for harvesting. In the most recent technology, there are numerous tree-chopping tools on the market, so sandalwood trees can be harvested by farmers using any tool. Soft woods from sandalwood trees are taken to the mill and the heartwood is transferred. This hard sandalwood is converted into powder using a machine. When producing oil and other cosmetic goods, this sandalwood powder is first soaked in water for two days.

The Macro-Microscopic Atlas album by Heartwood of Sandalwood (Santalum album L.):

Santalum album L.'s heartwood samples were acquired from a Chennai local market. The Captain Srinivasa Murthy Regional Ayurveda Drug Development Institute's Pharmacognosy Department at Arumbakkam, Chennai, India, authenticated the heartwood of the Santalum album, and the voucher specimens were placed (L/249 Wd 9) for future use. The macro morphological study was completed using the accepted procedures. The anatomical studies were completed in accordance with accepted practises. After being cleaned and thoroughly dried, plant material was powdered and put through sieve No. 80 for microscopic study. Standard techniques were used for mounting and staining. Powder and sections were with the aid of an Olympus BX51 microscope equipped with an Olympus camera, the object was seen and captured under various magnifications

Macroscopy:

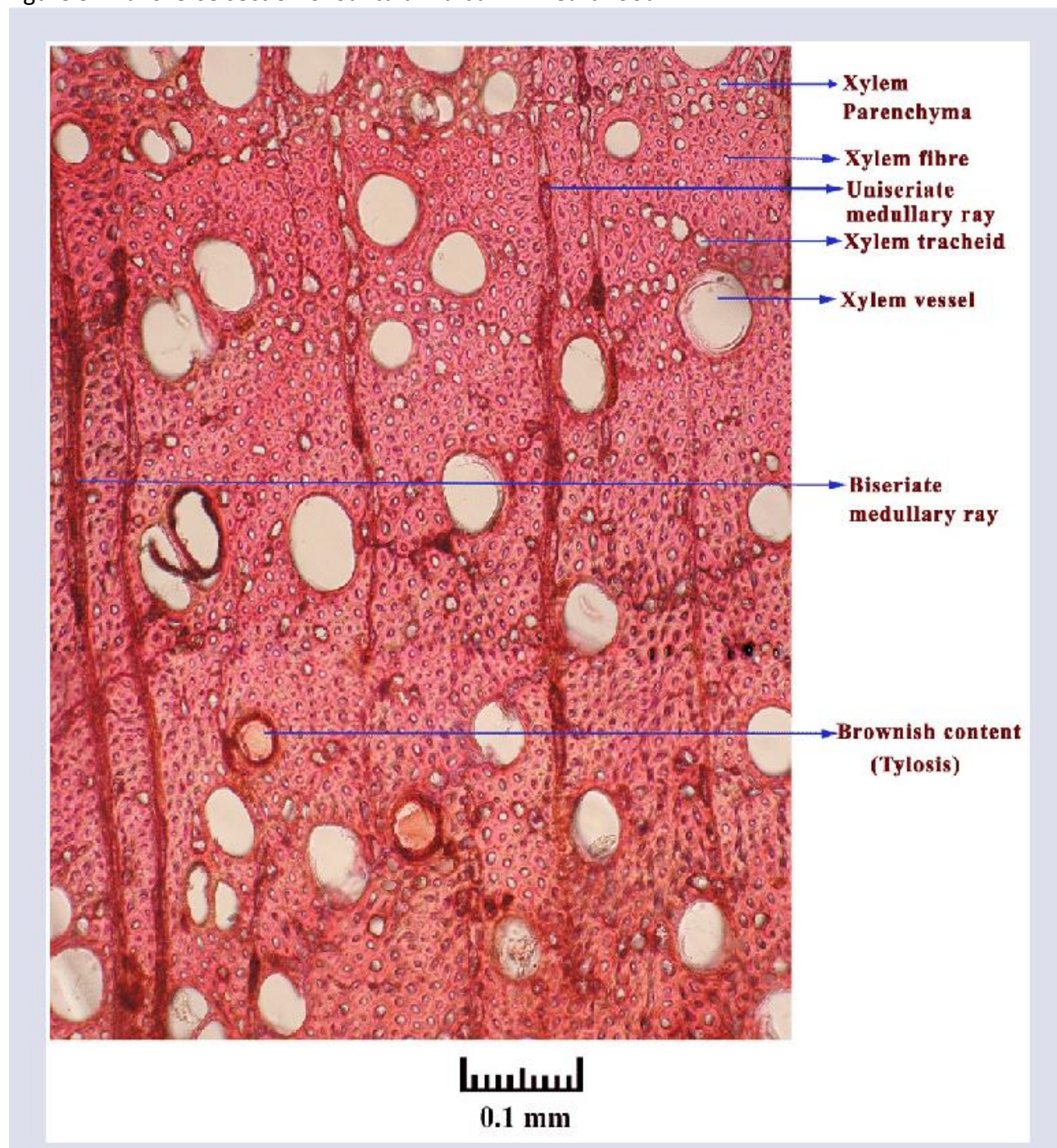
Macroscopical characters	Heartwood of <i>Santalum album L</i>
 colour, smell, and flavour	Pale golden to yellowish-brown in colour, with a pleasant and recognisable aroma and a mildly bitter and astringent flavour. Smooth, cut-smooth, and granular surfaces. Cut pieces with a length of 5 to 10 cm, a width of 1 to 4 cm, and a thickness of up to 1 to 3 cm. Hard, heavy, splintery material that snaps when broken.
 Surface	
 Size and Shape	
 Fracture and Texture	

Microscopy:

Heartwood cross-section reveals lone veins interwoven with Tylosis, which fills the majority of the wood and has thick walled, large lumen fibres embedded with brownish content; the vessels are arranged in dispersed pore, generally vesicentric parenchyma, almost parallel medullary rays, with the exception of when they slightly slant toward adjacent vessels

Powder microscopy:

Tylosis, fibres, pitted vessels with tails, uni and biseriate medullary rays, brownish content, and oil globules are the specific diagnostic features visible under a microscope.

figure 3: Transverse section of *Santalum album* L. heartwood.

Extraction Of Sandalwood Oil From Sandalwood:

essential oils are extracted from the *Santalum album*'s sandalwood using microwave technology

- 1) Microwave hydrodistillation
- 2) Microwave air-hydrodistillation

Methods And Materials:

The yield and quality of the extracted sandalwood oil are anticipated to improve with the inclusion of air flow in the microwave air-hydrodistillation. It is anticipated that the presence of air flow will help in transporting essential oil components that are hard to distribute in plant tissue or cell membranes. This is due to the fact that sandalwood oil is a heavy oil with heavy fraction components that are challenging to extract without the help of air flow. Consequently, to investigate the impact of the airflow in microwave air-hydrodistillation, the essential oil extractions from The techniques of microwave hydrodistillation and microwave air-hydrodistillation were used to extract sandalwood (from

the Santalum album).

To be employed in this study, sandalwood powder (Santalum album) was procured from Kupang, East Nusa Tenggara, and kept at room temperature until needed. All of the analytical grade aquadest and anhydrous sodium sulphate used in the experiment

1) Microwave hydrodistillation:

Twenty grammes of samples of sandalwood powder were added to a 1 L flask of deionized water (400 mL). The flask was setup within the microwave oven cavity and a condenser was used on the top (outside the oven) to collect the extracted essential oils (Fig.4). The microwave oven was operated at 600 W power level for a period of 2 h. This period was sufficient to fully extract the sample's essential oils. The separating funnel was used to separate the essential oil. To A separating funnel was used to separate the essential oil. To the essential oils were extracted, then dried over with water removed. amber vials containing weighed anhydrous sodium sulphate until they were needed for analysis, at 4 C.

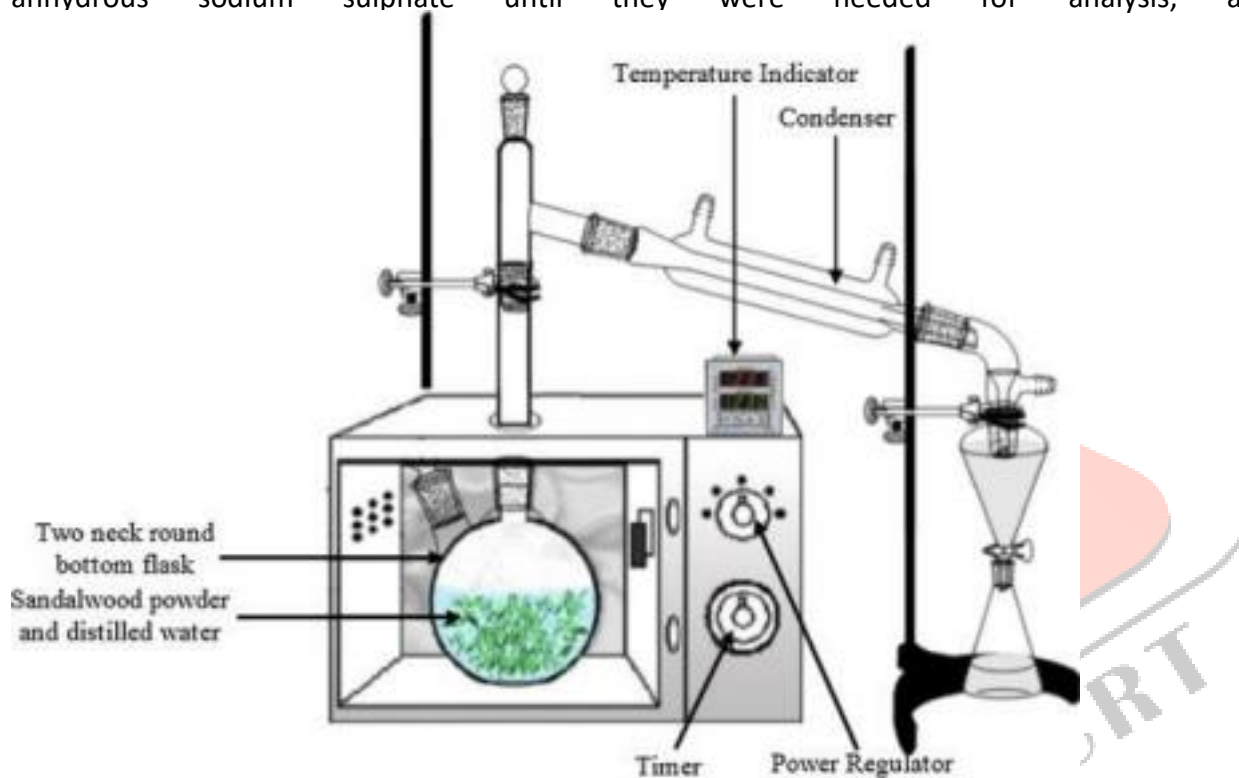


Figure. 4 Schematic representation of the microwave air-hydrodistillation apparatus

2) Microwave air-hydrodistillation:

It was adapted to operate as a microwave hydrodistillation device (EMM-2007X, Electrolux, 20 L, 800 W; variable in 200 W increments, 2.45 GHz). The microwave oven's PTFE-coated cavity has measurements of 46.1 cm by 28.0 cm by 37.3 cm. Twenty grammes of samples of sandalwood powder were added to a 1 L flask of deionized water. The flask was placed within the microwave oven cavity, and an exterior condenser was placed on top. It was adapted to operate as a microwave hydrodistillation device. The microwave oven's PTFE-coated cavity has measurements of 46.1 cm by 28.0 cm by 37.3 cm. Twenty grammes of samples of sandalwood powder were added to a 1 L flask of deionized water (400 mL). The flask was placed within the microwave oven cavity, and an exterior condenser was placed on top. the oven to gather the essential oils that were extracted. The distiller was filled with air using the compressor (MELZER V-777, electric motor: 1/5HP, maximum pressure: 3 bar). the deionized water and sandalwood powder. The air flow is then adjusted to match the operational requirements.

the flow metre was used to determine the research variables (Fig.5). For two hours, the microwave oven was run at 600 W of power. The sample was adequately extracted of all the essential oils during this time. A separating funnel was used to separate the essential oil. to be analysed. The following equation was used to determine the yield of sandalwood oil. The essential oils were extracted, dried over anhydrous sodium

sulphate to eliminate water, weighed, and kept in amber vials at 4 C until needed. to be analysed. The following equation was used to determine the yield of sandalwood oil. where V is the weight or mass of extracted sandalwood oil (g), W is the weight or mass of sandalwood powder, and y is the sandalwood oil yield (percent, weight-for-weight) (g).

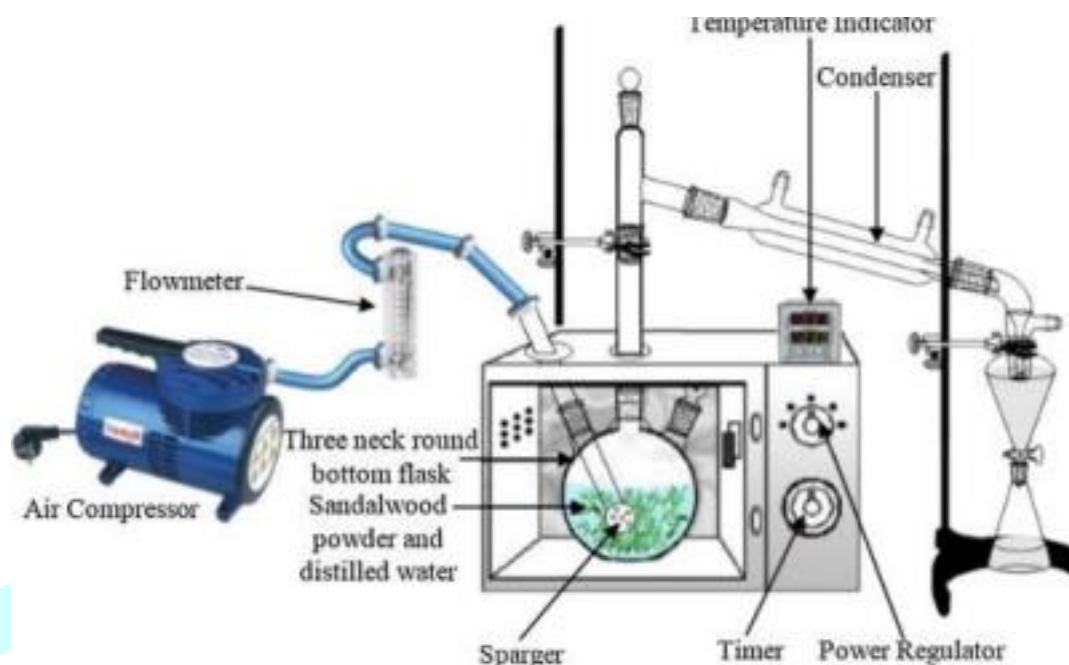


Figure. 5 Schematic representation of the microwave air-hydrodistillation apparatus

Religious purposes:

In Hinduism, sandalwood is frequently utilised in rituals and festivities. In alternative medicine, sandalwood is thought to help people get closer to God. In its purest form, sandalwood essential oil is extremely pricey and is largely used in Ayurvedic medicine to cure anxiety. Sandalwoods are regarded as belonging to the Padma (lotus) group in Buddhism and are associated with the Bodhisattva Amitabha. The sandalwood smell is thought to aid in changing one's desires and keeping one awake during meditation. When incense is offered to the Buddha, one of the most common smells utilised is sandalwood.

Hinduism:

The use of sandalwood paste in rites and celebrations, to emblazon holy objects and embellish religious iconography deities. Additionally, it is given to followers, who then put it to their necks, chests, or foreheads. the process of The responsibility of the paste belongs to the pure, thus it is given to them. only to priests in temples and during rites. The mixture is created by manually chopping wood on granite slabs. Designed with it in mind. Water is slowly added, then This produces a thick paste known as kalabham in Malayalam. To protect religious tonsure, sandalwood paste is used. the skin Sandalwood is used in Ayurveda and Hinduism believed to draw one nearer to the divine. This makes it one of the most prevalent sacramental substances in Hindu and Vedic cultures.

Jainism:

The usage of sandalwood is a crucial component in Jainism's daily rituals. Jain tirthankar deities were worshipped with sandalwood paste and saffron. Jain Monks and Nuns (Sadhus and Sadhvis) bestow blessings on their disciples and followers in the form of sandalwood powder.

Buddhism:

Several suttas in the Pali Canon reference sandalwood. Sandalwood is utilised in several Buddhist traditions. regarded as belonging to the padma (lotus) group and credited the Buddha Amitabha. Sandalwood is thought to have a fragrance how to change one's desires and uphold one's awakens during meditation. Moreover, it is one of the more common fragrances used to present incense to the Buddha the guru, too.

Islam:

As a sign of devotion, the disciples of the sufi apply sandalwood paste to the grave of the sufi. Particularly among followers from the Indian Subcontinent, it is practised. No matter the sufi's religion, in Tamil culture, sandalwood paste or powder is placed to their tombs as a sign of respect and devotion.

Chinese and Japanese religions:

The two incense materials most frequently used by the Chinese and Japanese in worship and different ceremonies are sandalwood and agarwood. However, Taoists must use agarwood or, even better, *Acronychia pedunculata* incense in place of sandalwood (as well as frankincense and benzoin resin, which are also produced outside) (Dastur, 1962).

TRADITIONAL USE:

White sandalwood (=Chandana) has mostly been employed as a demulcent, diuretic, and moderate stimulant in the Indian traditional medical system Ayurveda. Traditional uses of sandalwood oil include the treatment of bronchitis, fever, urinary tract infections, mouth and throat irritation, liver and gallbladder complaints, burns, headaches, burns, and burns. The oil is used in Ayurveda as an antiseptic, cooling, diaphoretic, antipyretic, antiscabietic, diuretic, expectorant, stimulant, expectorant, carminative, cicatrisant, antiphlogistic, antiseptic, antispasmodic, aphrodisiac, and astringent as well as in the treatment of bronchitis, psoriasis, palpitations In addition to other plant mixes, sandalwood oil has been used to treat stomach illnesses, in treatment of elephantiasis and lymphatic filariasis. On the basis of pharmacological testing, the hydrolyzed exhausted sandalwood powder (HESP) showed antiremorogenic, antiinflammatory, antimitotic, antiviral, anticancerous, hypotensive, antipyretic, sedative, ganglionic 89 blocking, and 90 insecticide properties Sandalwood oil has historically been used to treat venous and lymphatic stagnation, including varicose veins and enlarged lymph nodes of the lymphatic system. The medicinal potential was attributed to santalols, which have an anti-inflammatory effect. Sandalwood (=Tan Xiang) was used by herbalists in traditional Chinese medicine (TCM) to cure a variety of ailments, including dermatitis, stomachaches, vomiting, anxiety, cystitis, weariness, frigidity, impotence, and stress. Sandalwood is said to be effective in cases of any form of chest symptoms, whether they come from the lungs or the heart. The controlling and distributing action is effective in treating angina pain. Also mentioned in *Discorides' De Materia Medica* is sandalwood. Additionally, the German Commission E monograph advises using 1/4 teaspoon (1-1.5 g) of sandalwood oil for discomfort, fevers, and heart support in addition to supporting the treatment of urinary tract infections. Food products like confectionery, baked goods, gelatine, puddings, pan masala, frozen dairy desserts, and alcoholic and non-alcoholic beverages all employ sandalwood oil as a flavouring agent.

PHARMACOLOGY

Numerous pharmacological studies on sandalwood and its oil have revealed a variety of biological benefits, including aromatherapy, antibacterial properties, anticancer properties and other properties. Here is a list

of the reported pharmacological effects of sandalwood and its oil:

Aromatherapy with sandalwood:

Aromatherapy, commonly referred to as essential oil treatment, has many health and relaxation-related advantages. Sandalwood, which derives from mature "Santalum album" or East Indian sandalwood trees, is one of our favourite aromatherapy scents. We also appreciate sandalwood since it has a long history in ancient cultures because to its smell and health advantages.

Antiseptic:

Sandalwood oil is a powerful antibacterial that may be used internally and externally and is safe to use. Sandalwood oil can be applied externally to treat acne, ulcers, boils, and pimples that are infected or turning septic.

Anti-inflammatory and Antioxidant properties:

Both sandalwood paste and oil are potent anti-inflammatory treatments. There is evidence to support the claims that sandalwood oil has a calming, cooling effect and instantly relieves inflammation caused by fever, an excessive amount of antibiotics, insect bites, or wounds in the brain, gastrointestinal tract, nervous system, circulatory system, and excretory system.

Body:

Due to its well-known action on the genito-urinary tract, sandalwood is effective in treating gonorrhoea and cystitis (when combined with bergamot and tea tree). Additionally, sandalwood is effective at treating sore throats, chronic bronchitis, dry, persistent coughs, and other respiratory infections. Myrtle, frankincense, ravensara, thyme, linalool, or lemon are some suitable supplemental oils. Due to its calming effects, sandalwood is especially useful at night when it helps improve a cougher's quality of sleep. Sandalwood has a low level of toxicity, making it a suitable oil for topical application, bath usage, and inhalation. Sandalwood is also thought to be a digestive aid when combined with other ingredients, such as peppermint, ginger, or the spice oils.

Heartburn, nausea, diarrhoea, and vomiting can all be helped by it. Last but not least, sandalwood's function as a sexual tonic is of no less significance. Jasmine and sandalwood both offer calming, calming effects in addition to possible hormonal effects. It is a superb aphrodisiac, effective for both frigidity and impotence.

Soul & Mind:

Sandalwood is relaxing and beneficial as a meditation aid. It is ideal for dealing with the stresses of a job. chaotic existence as it aids in the reduction of tension, perplexity, fear, and obsessions It is also widely acknowledged to be an effective aphrodisiac and antidepressant Sandalwood assists us in breaking free from old bonds and moving forward. past sadness, emotions of solitude, egocentrism, and aggressiveness It opens us up and allows us to receive love. warmth and comprehension Sandalwood has the potential to reconnect us with ourselves and with nature. earth, in order to quiet the mind and allow creativity and higher consciousness to blossom One example is sandalwood. One of the oldest and most well-known aromatics, having been in use for almost 4000 years. It is operational as in a common Sandalwood is found in several of the world's main religions: in Buddhism, Hinduism, and Islam, it is at the heart of their fragrant characteristics, aiding in the realisation and bringing of the divine within. It has long been regarded as a

significant meditation tool.

Ayurvedic Medicine:

Sandalwood, considered one of the most valuable gifts of Ancient India, has been a prominent ingredient used in Ayurvedic remedies to treat a variety of conditions such as the common cold and stomach disorders.

Used as a cooling agent for Pitta, heat, and fire conditions. Sandalwood is used crushed to a paste for antifebrile, anti-inflammatory, and anti-infectious properties.

Siddha Medicine:

It is a diuretic that is used to treat bladder irritation, cystitis, and urethritis vaginitis. It is used to treat eye problems characterised by excessive secretion, redness, and burning. It can help with menorrhagia and profuse white discharge (leucorrhoea). Chandana is used in the treatment of acute dermatitis, gonorrhoea, and palpitations.

Chinese Medicine (TCM):

Skin problems, acne, dysentery, gonorrhoea, anxiety, cystitis, weariness, frigidity, impotence, nervous tension, eczema, stomach discomfort, vomiting, and stress are all treated with sandalwood.

Perfumery:

Because of its incredible ability to mix practically any note, sandalwood is highly valuable in high-end perfumery. It's a favourite fixative since it's deep and rich while being inconspicuous, smooth, and sweet. Its lengthy, lasting, and delicate scent makes it an excellent base note. Sandalwood is the most complementary of all notes.

Skincare:

Sandalwood is beneficial to all skin types, particularly dry, oily, and acne-prone skin. It has hydrating qualities as well as being a mild astringent and antibacterial. Sandalwood is also useful for treating cracked, chapped, and irritated skin. It is also suggested for older and exhausted skin, as well as stretch marks and scars.

Enhance hair growth:

The synthetic sandalwood aroma was chosen because it is an odour molecule that is highly likely to connect to the OR2AT4 receptor. The researchers discovered a 25–30% rise in the release of a growth hormone in the scalp. In other words, the hormone is important in encouraging hair development.

ANTIFUNGAL PROPERTIES:

Sandalwood oil has been shown to have antifungal efficacy against *Microsporum canis*, *Trichophyton mentagrophytes*, and *Trichophyton rubrum*. Sandalwood oil has been shown to be effective against human infections. harmful fungi *Microsporumcanis*, *Trichophyton mentagrophytes*, and *Trichophyton rubrum*, but *Candida albicans*, *Aspergillus niger*, and *Aspergillus fumigates*

ANTIOXIDANT ACTIVITY:

A hydro-alcoholic extract of *S. album* stem (SASE) was found to have anti-ulcer action. 5000 mg/kg dosage Two SASE test doses (250 and 500 mg/kg) were tested for anti-ulcer efficacy using three in-vivo models:

water immersion - restrain stress, ethanol, and In albino wistar

rats, indomethacin produced gastrointestinal ulceration models. Proton pump inhibitor Standard medicines were omeprazole 10 mg/kg and Ranitidine 50 mg/kg, an H₂ receptor antagonist. The findings demonstrated an improvement in gastric protection as evidenced by a substantial decrease (p 0.001) in the average number of ulcers, severity of ulcers, and cumulative ulcer index test groups. The foregoing conclusions were backed by histopathological data. SASE's anti-ulcer impact at 500 mg/kg was comparable to that of conventional medicines utilised in the tests, demonstrating substantial anti-ulcerpotential, particularly at higher concentrations.

ASTRINGENT:

Although mild, sandalwood oil contains astringent qualities that cause contractions in the gums, muscles, and skin. This is good in terms of strengthening the grip of gums on teeth, muscular strengthening, skin tightening, and so on.

Industrial applications:

This species is highly valued for its heartwood and oil, which are widely utilised in the cosmetic, perfume, pharmaceutical, and aromatherapy sectors. Sandal bark is a raw material used in the industry. On repeated Chromatography over alumina, benzene extract of powered bark yielded a novel triterpene solid ester (yield 0.3 percent), which was identified as urs-12-en-3-beta-yl-palmitate (Shankaranarayana et al., 1980b). The substance is also a chemosterilant and an insect growth inhibitor (Shankaranarayana et al., 1979a,b). The seeds contain 50- 60% of a drying oil that is composed of 80% santalbic acid, 2.5 percent stearolic acid, and 10% oleic acid.

Cosmetics and Beauty Treatment:



Fig.6



fig.7

Sandalwood has a wide range of medicinal characteristics that make it the best and most dependable home remedy for face and all forms of skin disorders such as eczema, psoriasis, and ringworm rash therapy.

Anti-tanning Property :

Sandalwood paste has anti-tanning properties and is one of the greatest clear skin cures for easing harsh sunburns and clear skin tanning. Sandalwood's natural oils naturally cleanse the skin's complexion and give it a healthy glow.

Property of anti-aging:



Fig.8.

The toning effect of sandalwood aids in the shrinking of skin pores, resulting in an even skin texture and the prevention of sagging and ageing skin. It tightens drooping skin tissues, giving the skin a supple and youthful appearance.

Skin Softening Action:

One of the most effective sandalwood oil benefits is that it ensures baby smooth skin. Sandalwood oil can be used alone or combined with other natural oils and massaged into the skin for the finest results.

Sandalwood Remedy for Skin Care:

The skin loses its suppleness as it ages and is constantly exposed to environmental contaminants. Make a paste with equal parts sandalwood powder, turmeric powder or holy powder, and lemon juice and apply it on your face. After 30 minutes, rinse with cold water.

It will leave your skin not only soft but also free of marks.

Pimple and Acne Treatment:

Sandalwood's potent antibacterial qualities successfully combat germs and fungi, preventing the formation of pimples and acne.

Sandalwood Remedy for Pimples:

Excess oil and sebum on the skin attract dirt and pollutants, clogging the skin pores and causing acne and pimple breakouts. Sandalwood is the most effective home remedy for acne and pimple breakouts.

Procedure:

Make a paste with 1 tablespoon of sandalwood powder, 12 tablespoons of turmeric powder, and 1 tablespoon of rose water.

Apply a layer of this paste to your face and leave it on for about 20 minutes before washing it off with water. This will help you eliminate pimples while also making your skin happy.

Itching and infections:

on the skin can be relieved within 30 minutes of applying sandalwood on the skin. It also aids in the reduction of inflammation, skin redness, and painful skin.

Sandalwood Rashes and Allergies Remedy:

Procedure:

Mix 1 teaspoon of sandalwood powder with a pinch of powder camphor, then add enough water to

produce a thick paste. Apply the paste evenly to the allergic skin and rashes. Allow it to dry for 1 hour before washing it away with cold water. This is one of the most effective natural treatments for psoriasis, eczema, allergies, and burns. Rashes, infection, and allergies are common among people with sensitive skin.

Prickly heat solution :

Excessive heat and sweating during the summer season frequently result in uncomfortable and painful prickly heat. The astringent cooling property of Sandalwood naturally cools the skin and relieves prickly heat.

Prickly Heat Remedy with Sandalwood:

Summer brings with it sweat and heat, which can create annoying prickly heat.

Procedure:

To make a thick paste, combine 2 teaspoons of sandalwood powder and 2 teaspoons of water. This paste should be applied to the affected parts of the face, arms, neck, chest, and back. After 1 hour, wash it off with water.

This relieves and cools the irritation and burn produced by prickly heat and excessive sweating. It is a child-safe remedy. It is preferable to use it since childhood to make their skin shiny and free of any skin condition or scarcinosis

Adulterants:

Adulterants include castor oil and, on the Continent, oil of cedar, which is created by distilling the chips left over after the manufacture of lead pencils.

Future scope:

Mosquito Repellent Sandalwood:

Sandalwood essential oil is extracted from the heartwood of Sandalwood trees and has a warm, woody aroma that is valued for its use in skin care, meditation, and stress treatment. It has been shown to soothe the body, support the immune system, alleviate moderate depression, and strengthen emotions. Although humans enjoy its aroma, not all insects do. It can be used to keep mosquitos away.

Forms:

Sandalwood mosquito repellent comes in a variety of forms, including popular incense sticks that last three to six hours depending on size, sandalwood sprays, and even perfume oils or balms.

Origins:

Sandalwood is commonly found in Australia (*Santalum spicatum*) and India (*Santalum album*). For millennia, numerous cultures have used sandalwood to repel mosquitoes by burning the leaves, bark, or wood.

CONCLUSION:

Santalum album is a precious plant kingdom gift that is intertwined with Indian culture and heritage. The essential oil, which contains over 200 compounds, is emerging as an intriguing and biologically useful active source of phytochemicals. The purpose of this review is to comprehend and present existing knowledge on the biological activities of this sandalwood tree, as well as its cultivation and harvesting and macro-

microscopy atlas album of sandalwood. The physical and chemical features of sandalwood oil derived by microwave hydrodistillation and microwave air-hydrodistillation processes can be used to determine its quality. The goal of this review is to comprehend and provide existing knowledge on the biological activities of this plant from a pharmacological standpoint for future clinical applications. Therapeutic potentials associated with this plant and its active chemical ingredients promise future healthcare applications, as demonstrated by the aforementioned pharmacological studies, such as the roles of santalols in combating cancer, tumour, viral diseases, microbes, oxidants, as well as anti-ulcer, skin nourishing agent, and as dietary factors, thereby supporting its traditional uses.

This evaluation also covers cosmetics and beauty therapy and their properties as well as the home remedies for skin conditions. India is the leader in the export of raw materials from the Santalum album and must remain so in the future; therefore, we must expand the area of healthy Sandalwood plantations, protect them, and the government should prioritise research and development of the Santalum album to increase export of quality raw materials. Here are a few ideas that can be implemented to boost the productivity of the Santalum album:

- Farmers should only purchase Quality planting material (QPM) stock where the seed source is known.
- Sandalwood plants should only be obtained from certified and accredited nurseries. Farmers are finding it difficult to protect their increasing sandalwood trees. Tree protection necessitates an investment equal to 30% of the estimated earnings. Rather than depending on physical tree protection, farmers should investigate the possibility of installing remote surveillance and protection systems, which are accessible and offered by companies such as Hitachi India Pvt Ltd.
- To increase grower revenues, rules and regulations governing the procurement of sandalwood from farmers by private enterprises should be investigated. There are currently no commercial financial institution sandalwood tree insurance programmes. Nationalized banks should come up with financing schemes for sandalwood cultivation. As with horticultural crops, insurance companies could offer tree insurance programmes. Some State Medical Plant Boards are currently pushing sandalwood planting with subsidy schemes, which is an added incentive.

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