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Sandal safaid (*Santalumalbum* Linn.): A review since antiquity till today as Unani medicine.

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ABSTRACT

Sandal safaid (*Santalum album* Linn.) is one of the most important medicinal Plant in the world. It is very well known since antiquity for its perfumery and medicinal properties worldwide. Greek physicians were aware of medicinal properties of sandal from the time of Alexander. They used it widely as *qabiz* (astringent), *muffareh*, *muhallil awram* (anti-inflammatory) and *musaffi khoon* (blood purifier). It is cultivated in many countries like Malaysia, Australia, New Zealand, India etc. but Indian variety is considered to be the best among all varieties. Seeds and wood is used to extract oil.The essential oil extracted from the wood is known as "East Indian sandal wood oil". Chief constituent of oil is santalol (alpha and beta-santalol). It has been introduced into red list of threatened species as vulnerable.

Keywords: Sandal safaid; Unani medicine; Santalum album Linn; Santalol.

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INTRODUCTION

Sandal, regarded as "Royal tree"[1] was known to Greeks from the time of Alexander.[2] In ancient Unani literature there is description of two varieties of sandal as *sandal surkh* and *sandal safaid*, having different pharmacological action. *Santalm album* Linn.is the second variety i.e *sandal safaid.* The heart wood of the tree is very fragrant and it is one of the oldest known perfumery and it has over 2,000 years of uninterrupted history.[3] Constantinus africanus, physician of school of salern, appears to have been the first to use it medicinally. In Europe Dr. Handerson of Glasgow, and Dr. Panasgubler and simmouet of France, has directed the attention of European physicians to the valuable properties of the oil as remedy for gonorrhoea. According to *kathasaritsagara,* it is one of the trees of buddhic paradise and chariot of sun is made of its wood bound with gold.[2] The systemic cultivation of plant is undertaken in south Indian states of Karnataka and Tamil nadu.[4] The species belonging to this genus are usually parasitic on the roots of other plants.[5] Trees more than 25 yrs old are selected for collection of oil.[4] The essential oil known as "East Indian sandal wood oil" which is pale yellow or yellow in color, somewhat viscid, having characteristic persistent aromatic odour, unpleasant nauseas taste and is rich in volatile constituents.[1,6,7] East Indian sandal wood oil is the only medicine of herbal origin officially accepted in the British pharmacopeia.[8] It is among the most important medicinal plants in world. It has been introduced into red list of threatened species as vulnerable. The first Invitro micro propagation study among woody forest plant was done for sandalwood.[9]

Botanical name: *Santalum album* Linn.[2,3,4,5,6,7,8,9,10,13,14,15,16,17,18,19,20,21]

Synonyms: *Syrium myrtifolium,* Roxb[10,18,19]

Family: Santalaceae[1,2,3,4,6,7,10,13,14,15,17,18,19,21,22,23]

Vernacular names:

Arabic : *Qut*[12]

Urdu : *Safaid chandan*[16] *sandal safaid*[11,24]

Hindi : *Safed chandan* [3,5,7,13,17]

Unani : *Sandal safaid*[10,11] *Halus taqaqeer*[12]

Sanskrit :*Srigandha,*[10,16,17] *Swet chandan,*[17] *Chandanam*[5,17] *Gandashra, Bhadra shree,*[17] *Chandana*[7,10,15]

Kannada : *Chandana,*[15] *Srigandha*[3,5,7]

Tamil : *Sandanam,*[5] *Ingam*[15]

Bengali : *Sada chandani*[16]

English : White sandal wood [3,10,13,16,17]

Morphology:

A small [5,17,18,22] to moderate sized [3,13,18,23,25] evergreen [3,5,6,13,17,18,23,25] semi-parasitic tree, [3,5,7,13,18,23,25] 20-30 ft. in height.[18] Branches are thin, leaves are narrow, oval, hardly ovate,[18,22] elliptic to lanceolate in shape [3,5,13,18] acute at each end, quite smooth, on petioles about ½ their own length,[13,18] arranged opposite to each other.[18,22] Flowers brownish or light red in colour. Fruits are black with single seed inside. The middle part of stem is fragrant; wood retains its property upto 30 yrs of age. It is not affected by insects. Bark is grey or nearly black [13,18] or reddish in color, rough, with deep vertical cracks on old trees. [13,5] Seeds and wood is used to extract oil.[11]

Habitat:

Drier regions of [10] southern parts of Karnataka.[4]e.g Mysore,[5,16,17,18,25] Coorg[16,17,18,25] and Tamil nadu state e.g. Coimbatore, Salem [6,16,17,18] and southern parts of Madras.[16,17,18,25] It is also found in parts of Pakistan,[16] Indonesia, [4,10] Deccan peninsula.[2] When grown away from its natural habitat it tends to loose much of its essential oil for which it is estimated in medicine. The trees growing on hard, rocky, ferrugimminious soils are richer in oil then those growing in fertile tracts. It has been reportedly introduced into Rajasthan, U.P, M.P and Orissa where it has become naturalized. [17]

Parts used: Seeds and wood [11]

***Mizaj*(temperament):**Cold 3^o& Dry 2^o [11,17,24], Cold & Dry 2^o [26,27]

Taste: Bitter

Sandal wood is Bitter, cooling, astringent, [2,11,17,28] sweet, acrid [11,28] and whereas Oil is unpleasant .[4]

***Afal (*pharmacological actions) mentioned in unani literature:**

- Qabiz (Astringent),
- Muffareh (cardiac tonic) [11,26,27]
- Munzij,(concoctive) [11]
- Musafi,(blood purifier) [11,17]
- Dafe atish (relieves thirst) [11]

- Muqawi meda ,(tonic to stomach)[11,17,27,26]
- Muhalile awram,(anti-inflammatory)
- Qatile deedan, (antihelmenthic) [11]
- Mudire baul,(diuretic) [11,16,17]
- Musakin, (analgesic) [17]
- dafe' taffun, (Antisceptic) [16]
- Jali, (Cleanser)[17]
- Dafe' bukhar (antipyretic) [17]

Medicinal uses in Unani medicine

- Sandal is used in conditions of safravi bukhar (bilious fever). [24]
- Sandal is used in urinary tract infections to relieve its symptoms and treats gonorrhoea.[11,16,17]
- Useful in people with Garam mizaj (hot temperament).
- Used in zofe-meda (weakness of stomach).
- Applied in the form of zimad (lininment) over chest in case of khafqan (Palpitation).
- Sandal safaid and anzarut (Astragalas sarcacola)in equal quantity is mixed with baize murgh (oil extracted from egg yolk) and is applied over temples headache.[26]
- Sandal powder taken with cow's milk treats gonorrhoea.[11] 10 to 30 drops of sandal oil, mixed with cow's milk used thrice a day is an effective remedy for gonnorhea.
- Its zimad(liniments) applied over forehead relieves safravi darde sar (bilious head ache).
- Used to relieve safravi dast (bilious diarrhea).
- Sandal safaid and kafoor(camphor) grinded in arqegulab(rose water) is advised for inhalation in cases of bilious headache.[11]

***Miqdar*(Dosage)**

Wood: 5-7 gms,[27] 3-6gms[10]

Oil: 3-40 drops thrice daily,[13] 1-2grams [11]

***Muzir*(Side effects):**

Decreases libido. [11]

***Musleh*(Corrective):**

Shahad(Honey) and *Misri*(Sugar candy). [11]

***Badal*(Substitute):**

Kafoor in a half dose of *sandal*[11]

***Murakkabat* (Compound formulations mentioned in Unani literature)**:

- Itrifile zamani,
- Halwae suparipak,
- Khamira abresham hakim arshid wala,
- Khamira abresham sheera unabwala,
- Sinoone mujalli,
- Sharbate sandal
- Arq ma' ullaham ambari banuskhakalan,
- Majun sohagsonth. [16]

Scientific actions proved are as follows

Wood:

- Cooling [2,21]
- Appetiser, [23]
- Analgesic, [23]
- Astringent, [21,25]
- Anti-inflammatory, [29]
- Sedative, [19,21,25]
- Diaphoriatic, [7,10,13,19]
- Antipruritic, [13]
- Diuretic, [7,10,13,25]
- Expectorant.[7,10,13,25]

Oil:

- Antiviral,
- Antifungal [9,23]
- Antipyretic [9,21]
- Antiscabietic[9]
- Antibacterial [9,20,30]
- Tonic (heart, stomach and liver)
- Antipyretic,
- Memory enhancer,
- Blood purifier [25]

- Astringent [16,17]
- Diuretic [16]
- Antiseptic for genitourinary tract infections[8,9,10,16,17,25]
- Bacteriostatic against gram positive bacteria [10]
- Cooling [7,10,13,25,7,10]
- Expectorant [7,10,13,25]
- Diaphoretic [7,10,13,25]

Therapeutic uses:

- Paste made of sandal with rose water and camphor is used to relieve headache.[2]
- Oil is used in treatment of dysuria [4,13] and frequency of micturition in tuberculosis of bladder.[4]
- Oil is given about one & half hour before meals for subacute and chronic gonnorhea.[8]
- Wood is used in biliousness, fever, and excessive thirst .[16]
- Sandalwood in the form of emulsion is used for cooling the skin in prurigo, erysipelas, pruritis and inflammation. [13,16,17,18,19]
- In case of morbid thirst the powder of sandal is taken with coconut water.[17]
- Two tola (20gms) of the watery emulsion of sandalwood mixed with sugar, honey and rice water is given to relieve thirst, to check gastric irritability and dysentery. [17]
- Decoction of wood, mixed with dried ginger is beneficial in haemorrhoids. [13]
- Pills made of sandal wood [16] with cow's milk are prescribed in gonorrhoea. [2,13,16,18,17]
- Used in vomiting, poisoning, hiccoughs, urticaria, eye infection and inflammation of umbilicus. [25]
- The famous German medicine salvarsan is said to be the preparation of essential principles of sandal oil. [17]

Chemical constituents:

The most important constituent of sandalwood is fragrant essential oil.[2,18] chief constituent of which is santalol (C_{15} H_{24} O), alpha and beta-santalol.[4,5,6,10,13,14,25] Characteristic odour and medicinal properties of sandalwood oil are due to the santalols.[5] Other constituents include sesquiterpine hydrocarbons alpha, beta curcumine alpha, beta, epibeta-santelene, beta farnesene and dihydroagarofuran.[10] Phytochemical analysis suggests that the extracts were rich in terpenoide (monoterpenoids and sesquiterpenoids), saponins, phenylpropanoid such as phenolics, proanthrocyanides, flavonoids, condensed tannins, o-quinines and polyphenols.[9]

Pharmacological studies:

Invitro anti-fungal activity:

A detailed study was carried on seven essential oils and their constituents for their antifungal activities against eight strains known to be human pathogens. Sandalwood oil was found to be effective against Microsporumcanis, Trichophyton mentagrophytes & T. rubrum but ineffective against Candida albicans, Aspergillus niger, A. fumigatus in comparison to Tolnaphtate and clotrimoxazole .[25]

Antimicrobial activity:

The antimicrobial activity of aqueous extract of leaf and stem of Santalum album against E. coli, Staphylococus aureus, and Pseudomonas. Results found that leaf extract showed higher[29]

Antibacterial activities of oil & bark*:*

Investigations reveal that antibacterial efficacy of some Indian essential oils including Sandalwood oil against Baccilus anthracis (+), Bacillus mycoides (+), Sarcinalutea (+), Micrococus glutamicus (+), Salmonella Paratyphi (-), Styphalococus albus (+), Xanthomonas campestris (-), and Xanthomonas malvacearum (-), E. coli at different conc. not only oil but the aqueous extract of air dried powdered bark showed good activity against virulent species, staphylococcus aureus.[29] Aqueous methanol extract of Santalum album showed antibacterial activity against Pasteurella multocida, E. coli, Staph aureus, Cornibacterium bovis, bacillus cereus.[30]

Antiviral activity of sandalwood oil against herpes simplex virus-1&2:

Effect was dose dependent and more pronounced towards HSV-1. A slight diminution was of the effect was seen at higher multiplicity of infections.[25]

Skin cancer and chemo preventive efficacy of santalol:

It has been studied for its skin cancer preventive efficacy in murine models of skin carcinogenisis; employing human epidermoid carcinoma A-431 cells it was assessed whether alpha-santalol at concentrations of 25-75µml resulted in a concentration and a time dependent decrease in cell number, which was largely due to cell death.[25]

Antioxidant activity:

Santalum album along with other herbs has been proven to contain antioxidant principles .[25]

In treatment of angina attacks as herbal Kuan-xiong aerosols:

kuan-xiong aerosols contain sandalwood oil along with oil of piper longum, Dryobalanops aromatic, Asarumseiboldi, officinarium. An immediate and quick relief in angina pain was proved in 69 cases of angina in comparison with angina.[25]

The evaluation of nitric oxide scavenging activity of certain Indian plants invitro: a preliminary study:

The extracts of Indian medicinal plants including S. album were examined for their possible regulatory effect on nitric oxide (NO) levels using sodium nitropruside as an NO donor invitro. Most of the plants demonstrated direct dose dependent scavenging on NO and exhibited significant activity.[25]

Clinical evaluation in treatment of various eye infections as herbal eye drop preparations:

Herbal eye drops in which one of the constituent was Santalum album was studied for refractive error and cataract for six months some improvement was there in the associated symptoms but subjective improvement of vision were reported in some patients .[25]

Anti inflammatory effect:

Investigations reveal the anti-inflammatory effect of sandalwood oil against formalin induced paw oedema in as albino rats.[25]

Anti-ulcerogenic activity:

Anti-ulcerogenic effect of herbal preparation containing Santalum album. This preparation in a dose of 600mg /kg significantly reduced the occurrence of stress, aspirin, and alcohol in albino Wistarrats.[25]

Antipyretic effect:

A significantly high antipyretic effect seen in case of sandalwood oil and HESP against yeast induced pyrexia in albino rats.[25]

Effect on BP/respiration:

A prolonged fall in carotid BP, increase in heart rate and respiration due to sandalwood oil has been observed .[25]

Comparative phytochemical analysis and antibacterial efficacy of in-vitro and in-vivo extracts from East Indian sandalwood tree:

During the course of experiment a well manifested paradoxical effect was also observed, where a higher dose of sample was found less effective than a lower dose. Sandal wood oil constituents are considered strongly antimicrobial and antibacterial. Staph aureus is one of the most susceptible to plant extract.[9]

CONCLUSION:

From the above detailed review it is concluded that *Sandal safeid* is a potent drug used in pharmaceutical industries. Due to its rich and pleasant fragrance it is widely used in cosmetic

industries. In accordance to Unani physicians as mentioned in classical literature it is widely used since ancient time for its therapeutic property both internally and externally. Nowadays people are more concerned about the safety of drug and therefore are more inclined towards herbal medicine. Studies have to be conducted to explore and validate the claims of Unani physicians for its different pharmacological actions.

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