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Sandalwood Oil: A Pandora Box

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Abstract: *Moden Era and Industralization has resulted in the development of various ailments. Nature has blessed us with the best. Medicinal plants and essential oils are of great benefit for the treatment of various disorders such as asthma, Chronic Obstructive pulmonary disorders, carcinoma and various microbial infections.. Medicinal Plants were used for heaps of years to taste and preserve food, to deal with fitness issues and to save you illnesses inclusive of epidemics The substantial use of natural treatments and healthcare arrangements is defined within side the Vedas and the Bible. Sandalwood is very well known medicinal plant with various benefits This review has been designed to highlighted the various medicinal aspects of Sandalwool/oil.*

Keywords: Asthma, Chronic Obstructive Pulmonary Disorder, Industrialization. Sandalwood.

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1. Introduction

Santalum album. L. commonly known as Chandana, or sandal or Srigandha (Sanskrit) belonging to family Santalaceae family is a hemi-parasitic evergreen tree that's renowned for its pleasant heartwood [1-3]. The International Organization for Standardization designated Santalum album (East Indian Sandalwood) and Santalum spicatum (West Australian Sandalwood) as standards from these types (ISO) [4]. Literature review indicated that the White sandalwood contains 41–55% α-santalol and 16–24% β-santalol as active components. Further, The oil concentration of sandalwood was higher in heartwood of older trees (2–6.2%) as compared too young heartwood trees (0.2–2%). Beside this Sandalwood too comprises of Hydrocarbons (santene, nortricyclo-ekasantalene), and α-santalenes, alcohols (santenol, teresantalol), aldehydes (nor-tricyclo-kasantalal), and β-santalic acids, and teresantalic acids [5]. The quality and pleasant characteristic aroma of sandalwood and its oil is due to the presence of sesquiterpene alcohols, such as Z α-santalol and Z β-santalol [6-8]. Sesquiterpene synthase enzymes are responsible for the biosynthesis of sandalwood sesquiterpenes, and each type of sesquiterpene has its own set of enzymes. Although the enzymes are genetically controlled, additional environmental factors may influence sesquiterpene production [9, 10]. The bark of Sandalwood is enriched in tannins (14%), fatty acids, and betasitosterol, a triterpene ester [11, 12]. It has been documented that the sandwood contains Urs-12-en-3-beta-yl-palmitate (0.3 percent), triterpene ester that possess chemosterilant and insect growth inhibitory properties [13]. In-addition to this, the leaves of Santalum album vitexin, isovitexin, orientin, isoorientin, chrysin-8-C-Dglucopyranoside, chrysin-6-C-D-glucopyranoside, and isorhamnetin were extracted [14, 15]. In Ayurveda Sandalwood has great medicinal properties emphasizing its action beyond the perfume-like aroma is utilised as an internal remedy for blood purification and revitalizing [16, 17]. Indian sandalwood is currently listed in the Ayurvedic Pharmacopoeia of India, the Chinese Pharmacopoeia, and the British Pharmacopoeia [18].

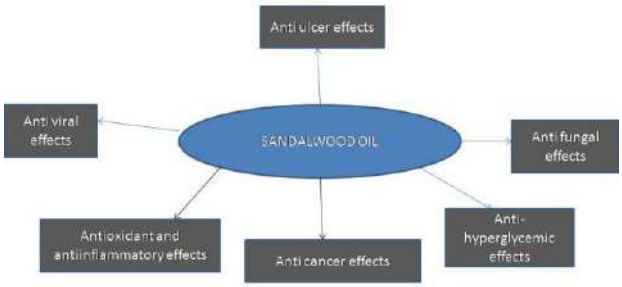

Fig.: 1. Representation of the effects of sandalwood oil.

Hence, with this mini review the various pharmacological potentials of Sandalwood is

brief out. Sandalwood is related with numerous therapeutic and pharmacological properties such as antioxidant, anti-inflammatory, anticancer, anti-hyperglycemic, hepato-protective, anti-ulcer, antibacterial, antifungal, antiviral, hemolytic, antipyretic and cardio protective [19]. Fig. 1 Depicts the therapeutic importance of Sandalwood.

2. Pharmacological Importance of Sandalwood oil

2.1 Anti-inflammatory effects of sandalwood oil

The anti-aging skincare benefits of sandalwood oil include its ability to relieve itching and inflammation of the skin, as well as its ability to hydrate dehydrated skin - and the astringent action of sandalwood oil (SDO) provides a great toning effect, which is great for oily skin, preventing scars from forming, and treating dry eczema [20]. Tyrosinase, a critical enzyme in the biosynthesis route for the pigmentation of the skin melanin, was discovered to be inhibited by alpha-santalol [21]. A variety of methods have been used to demonstrate Sandalwood oil's anti-inflammatory properties in vitro. A combination of the inhibition of 5-lipoxygenase (5-LOX) and 2, 2-diphenyl-picryl-hydrazyl (DPPH) radical scavenging action of SAO protects mouse livers from oxidative stress and the generation of reactive oxygen species in vivo [22-24].

2.2 Anticancer effect

The anti-carcinogenic effects of sandalwood oil on urinary bladder, oral cavity, and prostate cancer have been demonstrated in numerous studies [25, 26]. Keratinocytes have been shown to induce autophagy and apoptosis, suggesting that they might be able to prevent skin cancer from developing [27]. Activation of early antigens against the Epstein-Barr virus as well as in damaged double strands of DNA in MCF-7 and MCF-10A breast cancer cells is thought to be responsible for the oil's anticancer action [27]. Clinical studies have demonstrated that sandalwood oil and turmeric can prevent radiation dermatitis in women who have undergone radiation treatment for breast cancer. [28]. Further, Preclinically it was shown that oral gavages feeding of sandalwood oil to Male Swiss albino mice increased glutathione-S-transferase (GST) activity and acid soluble sulfhydryl levels in the liver in a time- and dose-dependent manner [29]. The increased GST activity and acid-soluble sulfhydryl levels suggest that sandalwood oil may have a chemopreventive effect on carcinogenesis via a blocking mechanism [30].

Based on a literature review, sandalwood oil (5 percent in acetone, w/v) inhibited the formation of skin tumors in CD-1 mice caused by 7,12-dimethylbenz [a]anthracene (DMBA) and accelerated by TPA-induced ornithine decarboxylase (ODC). There was a 70%

reduction in TPA-induced ODC activity, a 67 percent reduction in papilloma incidence, a 96 percent reduction in multiplicity, and a 67 percent reduction in papilloma incidence [31]. In CD-1 mice, pre-treatment with sandalwood oil reduced papilloma incidence and multiplicity in a concentration- and time-dependent manner. The most effective chemopreventive effects were shown 1 hour before DMBA and TPA treatments [32-35].

2.3 Hypoglycemic Effect

Alpha-santalol, has been demonstrated to have antihyperglycemic effects. Experimentally it was founded that mice with chemically induced diabetes when administered alpha-santalol, or glibenclamide, (i.p) significant improvement was elicited in the group administered alpha-santalol with respect to body weight, water intake, and protein in their liver [36]. In addition to this SDO has been reported to ameliorate hepatic insulin resistance by regulating JNK/NF-κB inflammatory and PI3K/AKT insulin signaling pathways [37].

2.4 Antiulcer effects of sandalwood oil

A promising anti-ulcer herb, S. album is recommended in the Unani system [38]. At a dosage of 600 mg/kg, UL-409, a polyherbal preparation containing six medicinal plants, namely Santalum album L., Glycyrrhiza glabra L., Saussurea lappa CB Clarke, Aegle marmelos Corr., Foeniculum vulgare Mill., Rosa damascena Mill., significantly reduced the incidence of ulcerations in albino wistar rats [39]. In another study, UL-409 increased stomach mucus as well as reduced free and total acid levels in rats. It also dramatically reduced ulcers caused by cold-restraint stress in rats. A massive reduction was also observed in gastric ulceration caused by alcohol and aspirin in rats and guinea pigs, as well as duodenal ulcers caused by cysteamine and histamine [40, 41].

2.5 Cardio Protective Effects of Sandalwood Oil

The cardio-protective properties of the aqueous extract of the sandalwood plant have been proven. In a rat model of doxorubicin-induced cardiotoxicity, the extract was found to minimize lipid peroxidation, thereby considerably reducing heart tissue damage [42]. In the year 2020 it was reported that the heart muscle's antioxidant capacity may be improved and inflammation may be inhibited by Sandalwood essential oil in Doxorubicin induced Cardiotoxicity [43].

2.6 Miscellaneous potential of Sandalwood oil

Previous studies have shown that some Indian essential oils, such as Sandalwood oil, have antibacterial efficacy against Bacillus anthracis (+), Bacillus mycoides (+), Bacillus pumilis (+), E.coli (-), Micrococcus glutamicus(+), Sarcina lutea (+), Salmonella paratyphi (-), Staphylococcus albus (+), Xanthomonas campestris (-), Xanthomonas. Not only the oil, but also the aqueous extract of air dried powdered bark in phosphate buffer at

concentrations of 25 to 1000 g/ml inhibited pathogenic species well. Staphylococcus aureus is a kind of bacteria [44]. Further in 2007 Schnitzler et al indicated the Susceptibility of drug-resistant clinical herpes simplex virus type 1 strains of various essential oils such as ginger, thyme, hyssop, and sandalwood [45].

3. Conclusion

Sandalwood plant is known for its fragranced wood and the essential oil extracted from the heartwood of the plant. These essential oils are used in various therapies, perfumery, cosmetic, food and pharmacological industries. The chemical constitutes of sandalwood oil have specific pharmacological values. With recent upsurge in research endeavours to verify the traditional healthcare uses of essential oil and their constituents by modern experimental approaches that have provided momentum to in depth pharmacological and mechanistic investigations. Also, the plant is associated with significant religious and cultural value since ancient times.

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