

Tea Tree Oil

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Tea tree oil is a popular ingredient in many over-the-counter healthcare and cosmetic products. With the explosion of the natural and alternative medicine industry, more and more people are using products containing tea tree oil. This article reviews basic information about tea tree oil and contact allergy, including sources of tea tree oil, chemical composition, potential cross reactions, reported cases of allergic contact dermatitis, allergenic compounds in tea tree oil, practical patch testing information, and preventive measures.

Cutis. 2005;76:178-180.

Allergen Aspects

Tea tree oil is an essential oil most often distilled from the terminal branches and leaves of *Melaleuca alternifolia*, a hardwood tree indigenous to the northeastern area of New South Wales, Australia.¹ The plant has been cultivated in other states of Australia, including Queensland and Western Australia, as well as in other countries.² Oil of *Melaleuca* terpinen-4-ol type (tea tree oil) and *Melaleuca* oil are additional names for tea tree oil seen in the literature and used by the International Organization for Standardization and the Therapeutic Goods Administration of Australia, respectively.³ The ISO 4730 International Standard for tea tree oil specifies quantities of 14 out of approximately 100 components in tea tree oil and notably requires tea tree oil to have at least 30% terpinen-4-ol and no

more than 15% 1,8-cineole (eucalyptol).^{3,4} Although eucalyptol is not an irritant, eucalyptus essential oil has eucalyptol as its major component.²

Sources and Exposure

Mass marketing of Australian tea tree oil as a natural cure for a variety of skin conditions has led to its inclusion in products such as cosmetics, shampoos, mouthwashes, ointments, soaps, lotions, deodorants, sunscreens, laundry detergents, toothpaste, fabric softeners, and cleansers.¹ Tea tree oil also is used for massage and aromatherapy and can be found in nonprescription medications for the treatment of athlete's foot, warts, acne, bacterial infections, lice, and psoriasis.⁵ Finally, tea tree oil is used by the general public and paramedical practitioners for a myriad of conditions.⁶

Tea tree oil's topical antimicrobial activity has been demonstrated in vitro against dermatophytes and other filamentous fungi, the yeast *Candida albicans*, gram-positive and gram-negative bacteria, and *Sarcoptes scabiei* var *hominis*.⁷⁻¹² In vivo trials have indicated tea tree oil's possible effectiveness against methicillin-resistant *Staphylococcus aureus* and as an alternative acne treatment.^{13,14} The terpinen-4-ol, α -pinene, linalool, α -terpineol, β -pinene, and 1,8-cineole components of tea tree oil all have shown antimicrobial activity in vitro.^{15,16} Martin and Ernst¹⁷ have noted that more well-designed clinical trials are needed to better determine the efficacy of tea tree oil treatments.

Irritant contact dermatitis is possible with oil used at a high concentration. Safety data on oral ingestion do not exist. A few cases of poisoning suggest it is likely toxic if large enough quantities are ingested.² Allergic contact dermatitis to tea tree oil has been repeatedly reported in the literature, the first 2 cases being described by Apted¹⁸ in 1991. Since then, allergic contact dermatitis due to tea tree oil has occurred when it has been used as a treatment for dog scratches, tinea pedis, insect bites, hand dermatitis, folliculitis, acne, bronchitis

Accepted for publication March 1, 2005.

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The authors report no conflict of interest.

No reprints available from author.

(inhaled tea tree oil vapors from a hot aqueous solution), warts, chronic vulvovaginitis, and skin abrasions. Also, systemic contact dermatitis has been described in a patient who ingested tea tree oil after using it topically as a treatment for atopic dermatitis.¹⁹ However, the composition of the oil in this report differed from the International Standard.³ In addition, Khanna et al⁵ reported allergic contact dermatitis to tea tree oil with an erythema multiformelike id reaction, and Mozelsio et al²⁰ reported an immediate systemic hypersensitivity reaction associated with the topical application of Australian tea tree oil used for the treatment of psoriasis. Contact dermatitis due to the use of tea tree oil has been reported to occur after months or years of use.^{21,22} Use of the oil on already damaged skin seems to be a risk factor for the development of allergy.¹ These varied clinical presentations indicate tea tree oil's popularity and scope of use among the public.

Gas chromatography has shown tea tree oil to be a mixture of almost 100 compounds.²³ Investigations to identify the allergen in tea tree oil have indicated several compounds. 1,8-Cineole (eucalyptol) was indicated in a case reported by De Groot and Weyland,¹⁹ whereby the oil composition did not meet the International Standard for tea tree oil.³ d-Limonene, α -terpinen, aromadendrene, terpinen-4-ol, p-cymene, and α -phellandrene were reported by Knight and Hausen,¹ and sesquiterpenoid compounds and α -terpinen were reported as allergens by Rubel et al.²⁴ It is important to note that oxidized tea tree oil appears to contain strong sensitizers that are not abundant in fresh tea tree oil; thus, oxidized tea tree oil should be used for patch testing.^{5,22} Hausen et al²² found a degradation product in oxidized tea tree oil, ascaridol, to be one of the strongest sensitizers. Lastly, Dharmagunawardena et al²⁵ found α -pinene to be the most common allergenic component in a series of 41 essential oils, including tea tree oil.

Patch Testing and Preventive Measures

Tea tree oil needs to be thought of as a possible cause of allergic contact dermatitis. Patients may need to be asked specifically about natural therapies and products they may have used. Adding tea tree oil to a screening series of allergens should be considered in patients who have used products containing tea tree oil. Tea tree oil for patch testing is available through Chemotechnique Diagnostics and Dormer Laboratories, Inc (www.dormer.com). It is available as oxidized tea tree oil 5% in petrolatum. Degradation products of photo-oxidized commercial tea tree oil are 3 times

as sensitizing as the nonoxidized, newly opened, fresh tea tree oil.²² Use of oxidized tea tree oil (old, opened tea tree oil) would be more likely to result in sensitization. Patients are more likely to have contact allergy to oxidized tea tree oil (oil obtained commercially and left on a windowsill in a clear container for 10–60 days). Coreactions or possibly cross reactions to d-limonene, a fragrance material, and turpentine have been reported and are deemed to be due to chemically related oxidized monoterpenes. Patients allergic to tea tree oil also may react to other essential oils, fragrance materials, compositae mix, and colophony.^{21,22} Tea tree oil products should be avoided if an allergy exists, and potential cross-reacting contactants should be discussed and considered in patients allergic to tea tree oil.

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