

# Essential Oils Debunked: Separating Fact From Myth

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## PRACTICE POINTS

- Essential oils (EOs) are present in many consumer products, including foods, cosmetics, pharmaceuticals, and household products; patients can develop contact allergy to EOs.
- Common EO allergens include tea tree oil, ylang-ylang oil, lavender oil, peppermint oil, jasmine absolute, geranium oil, rose oil, turpentine oil, and sandalwood oil.
- In general, EOs have good safety profiles, but caution must be taken when storing them.
- When patch testing for potential EO contact allergy, supplemental testing with both commercially available EOs as well as a patient's own products is necessary given there is strong variability in the composition of EO products.

Essential oils (EOs) are present in products we use at home, at work, and in our environment. In recent years, there has been an increasing trend to use EOs rather than products containing chemicals perceived as harmful by consumers. In this review, we separate the facts from the myths surrounding EOs and provide scientifically sound answers to common questions.

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## What is an essential oil?

An essential oil (EO) is defined by the International Organization for Standardization as a “product obtained from a natural raw material of plant origin, by steam distillation, by mechanical processes from the epicarp of citrus fruits, or by dry distillation, after separation of the aqueous phase—if any—by physical processes.”<sup>1</sup> Steam distillation is the primary method used for the production

of commercial EOs,<sup>2</sup> and believe it or not, most EOs contain 100 to 250 individual chemical components.<sup>3</sup>

The term *essential oil* often is incorrectly used for a variety of products obtained from plant material by methods other than distillation or cold-pressing, such as extraction. Products that are obtained via the extraction method include absolutes found in fine fragrances; hydro-lates such as rose water; concretes such as jasmine or violet leaves; and vegetable oils including olive oil, coconut oil, and sesame oil.<sup>2</sup> These products are not true EOs.

## Where do EOs come from?

Essential oils are produced in many countries around the world.<sup>4</sup> Individual oils may be obtained from species of different plants, from different parts of the same plant, or from various cultivars (plants selectively bred to obtain desirable levels of chemical constituents such as monoterpenes or sesquiterpenes and biochemical properties such as antibacterial or antioxidant activities).<sup>3,5</sup> It is estimated that EOs can be obtained from approximately 30,000 plant species, but only 150 EOs are produced commercially.<sup>2,6</sup>

## Why are people using EOs? What is their claim to fame?

Essential oils are employed by the flavor, food (eg, soft drinks, milk, candies, chocolate, meats, sausages, alcoholic beverages, spices, herbs, tea, preservatives, animal foods), fragrance, cosmetic, tobacco, and pharmaceutical industries. They also are used in household products (eg, detergents, fabric softeners, air fresheners, candles, incense) and for medicinal purposes (eg, folk and traditional medicine, phytotherapy, balneotherapy, aromatherapy).<sup>2</sup> The oils usually are applied to the skin but also can be administered orally, inhaled, diffused through the air,

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or used by other means.<sup>4</sup> One 2019 survey of Minnesota State Fair attendees (N=282) found the most common reasons for using EOs were a desire for alternative treatments (53.4%), the opinion that EOs are safer than traditional therapies (47.6%), and/or failure of standard medical treatments (10.7%). The survey results also indicated that 46.7% of EO users utilized EOs to treat medical conditions or symptoms.<sup>7</sup> Of note, review of the website of an international company that produces EOs confirmed that EOs are marketed not only for adults but also for children to help them concentrate,<sup>8</sup> sleep,<sup>9</sup> improve the appearance of their skin,<sup>10</sup> soothe upset stomachs,<sup>11</sup> and decrease sniffles due to colds.<sup>12</sup>

### Why are people selling EOs to family and friends? They must be making major bucks!

In general, the cost of EOs depends on the complexity of cultivated plant species; the mode of harvesting, which is sometimes done by hand; and the yield of oil. Prices range from \$4.50 to an incredible \$150,000 per kilogram.<sup>2</sup> On average, one bottle containing 5 to 15 mL of an EO or oil blend can cost anywhere from \$7 to \$251.<sup>13</sup> In the United States, the consumer EO market is partially composed of multilevel/network marketing companies in which direct consumer sales occur via a hierarchy of individual distributors. Goodier et al<sup>7</sup> found that 36.4% of participants who obtained EOs from family and friends purchased them through multilevel/network marketing companies. In 2018, individual distributors of an international EO-producing company made on average anywhere from \$4 to as much as \$1.54 million annually by selling the company's EO products and enrolling additional members/individual distributors to purchase or sell the company's EO products.<sup>14</sup>

### Sometimes EOs are described as natural and pure, but are they really?

Just because a product is labeled as "pure" or "natural" does not ensure that it is a good-quality EO. Organically produced (ie, grown without the use of herbicides or pesticides) plant material can include up to 30% of extraneous herbs and weeds, which can change the composition of the oil.<sup>2</sup>

Lesser-quality EOs are the result of adulteration, contamination, inadequate oil production, or aging.<sup>2</sup> Adulteration (eg, cutting, stretching, bouquetting) occurs when foreign substances are introduced into pure EOs for the benefit of a higher profit; to ensure a sufficient supply of oils; or to meet demands for cheaper oils by "stretching" a more expensive, pure oil by combining with a cheaper, less pure oil. Inadequate oil production leading to lower-quality oils can occur when a biomass is incorrectly distilled, either from too much steam or temperatures that are too high or due to lack of adequate cooling units. Aging occurs when the oils are not stored properly, resulting in a change in the chemical composition due to esterification, reduction, and oxidization of

chemicals, which leads to the formation of peroxides and hydroperoxides that can be contact allergens.<sup>15</sup>

### Can patients develop contact allergies to EOs?

The short answer is yes! Contact allergy to almost 80 EOs has been reported,<sup>15</sup> including tea tree oil,<sup>16,17</sup> ylang-ylang oil,<sup>17,18</sup> lavender oil, peppermint oil,<sup>18</sup> jasmine absolute,<sup>17</sup> geranium oil, rose oil,<sup>18</sup> turpentine oil,<sup>19,20</sup> and sandalwood oil.<sup>18</sup> The recent increased prevalence of allergic reactions to EOs likely is due to increased consumer use as well as increased detection from availability of commercial patch-test preparations.

Essential oils have many common ingredients. De Groot and Schmidt<sup>3</sup> documented that 14 of 23 chemicals present in more than 80% of EOs have been reported to cause contact allergy. Interestingly, allergic patients often react to more than one EO, which may be explained by the many shared chemical components in EOs.

### Essential oils are "natural" so they must be safe?

In general, most safety profiles are good, but rare toxic reactions from EOs have been observed.<sup>4</sup> A recent Australian study reviewed EO exposure calls to the New South Wales Poisons Information Centre.<sup>21</sup> The majority of EO poisonings were accidental or the result of therapeutic error such as mistaking EOs for liquid pharmaceuticals. Additionally, this study found that from July 2014 to June 2018, there was a 5% increase in the number of calls per year. More than half of EO poisoning calls involved children, with toddlers being the most frequent cases, suggesting the need for child-resistant top closures. The most frequently involved EOs in poisonings were eucalyptus (46.4% [n=2049]), tea tree (17% [n=749]), lavender (6.1% [n=271]), clove (4.1% [n=179]), and peppermint (3.5% [n=154]).<sup>21</sup> Essential oils do not come without potential pitfalls.

### What is the clinical presentation and workup?

The workup of EO allergic contact dermatitis begins with obtaining a history to evaluate for use of EO diffusers, perfumes, hygiene products, cosmetics, massage oils, toothpastes, and/or pharmaceutical products. Exploration of potential exposures through occupation, environment, and hobbies also is indicated. Clinical presentation is dependent on the mechanism of exposure. Contact allergy may result from direct application of an allergen to the skin or mucous membranes, contact with a contaminated environmental item (eg, lavender oil on a pillow), contact with EOs used by partners or coworkers (consort dermatitis), airborne exposure (EO diffusers), or systemic exposure (flavorings). Airborne dermatitis from EO diffusers may involve the exposed areas of the face, neck, forearms, arms, behind the earlobes, bilateral eyelids, nasolabial folds, and under the chin. History and clinical presentation can raise suspicion for allergic contact dermatitis, and patch testing is necessary to confirm the diagnosis.

## How do we patch test for EO contact allergy?

There are many EOs commercially available for patch testing, and they typically are tested at 2% to 5% concentrations in petrolatum.<sup>15</sup> A North American and European study of 62,354 patch-tested patients found that 7.4% of EO-positive individuals did not react to fragrance allergens in a standard screening series including fragrance mix I, fragrance mix II, and balsam of Peru, highlighting the importance of patch testing with specific EOs.<sup>22</sup> Currently, only 3 EOs—tea tree oil, peppermint oil, and ylang-ylang oil—are included in the 2019-2020 North American Contact Dermatitis Group screening series, making supplemental testing for other EOs important if contact allergy is suspected; however, testing the patient's own products is imperative, as there is strong variability in the composition of EOs. Additionally, aged oils may have been exposed to light, oxygen, or varying temperatures, which could result in the formation of additional allergenic chemicals not present in commercially available preparations.<sup>15</sup> In addition to commercially available allergens, we test patient-provided EOs either as is in semi-open fashion (ie, EOs are applied to patient's back with a cotton swab, allowed to dry, covered with adhesive tape, and read at the same interval as other patch tests<sup>23</sup>) or occasionally dilute them to 1% or 10% (in olive oil or mineral oil).

## How should I manage a positive patch-test reaction to EOs?

Patients should avoid relevant EO allergens in their products and environment, which can be easily achieved with the use of the American Contact Dermatitis Society's Contact Allergen Management Program (<https://www.contactderm.org/resources/acds-camp>) or similar databases.

## Final Interpretation

We are ubiquitously exposed to EOs every day—through the products we use at home, at work, and in our environment. Essential oils make their place in the world by providing sweet-smelling aromas in addition to their alleged therapeutic properties; however, beware, EOs may be the culprit of your next patient's allergic contact dermatitis.

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