

Citrus Peel Essential Oil: DIY Extraction and Everyday Application

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Citrus fruits are relished worldwide for their good taste and juiciness. Citrus fruits are not an ample source of nutrients, but the peels are also rich in many bioactive phytochemical compounds, such as essential oils (EOs), which have numerous health benefits. Typically, citrus peels are discarded at home after the fruits are consumed. However, citrus peels are a rich source of EOs, which are sold at high prices in the international market. Cold pressing and solvent extraction methods can be easily utilized at home for oil extraction, offering multiple benefits such as use in confectionery, aromatherapy, personal care, and other household purposes. Home extraction of citrus oils is an eco-friendly and cost-effective approach. Additionally, this approach promotes zero waste or minimizes waste.

Citrus fruits are one of the most important fruit crops grown throughout the world that belongs to the genus citrus and family Rutaceae. Oranges, mandarins, grapefruits, lemons and limes are the main commercialized citrus crops valued for their nutritional

value. Apart from the fresh consumption, one-third of the citrus produced are processed for juices and other value-added products. The peels of citrus are considered as an agro-industrial waste. Citrus peel (CP) is about 40-50% of the fruit weight. However,



citrus peel is a valuable by-product as it is an important source of bioactive components like phenolic compounds, essential oil (EOs), carotenoids and ascorbic acids. CP is rich

source of essential oil and is in great demand in the international markets for its pleasant sensory characteristic aroma and flavour along with having many health benefits. EOs are complex mixture of volatile compounds predominantly terpenes, phenolics and other aromatic substances. These secondary metabolites are responsible for multifaceted roles in plant ecology, including defense against herbivores and pathogens, attraction of pollinators and protection from environmental stressors.

Currently, around 3,000 essential oils (EOs) are known, with 300 of commercial significance.

Extracted from various plant parts—such as leaves, stems, roots, seeds, and flowers—these oils are widely used in fragrance, flavouring, cosmetic, and household industries. Global citrus EO production is about 16,000 tons annually, valued at \$14,000 per ton. Citrus peel essential oils (CPEO) can be easily made at home using a cold-pressed method, offering uses in cooking, aromatherapy, and beauty routines. Instead of discarding citrus peels, individuals can extract CPEO for personal use or potential small business opportunities, promoting sustainability and reducing waste.

Source of EOs

Essential oils are extracted from various plant parts—flowers, leaves, stems, bark, wood, roots, seeds, fruits, rhizomes, and gums—using steam distillation, cold pressing, or solvent extraction. Each plant source provides distinct aromas and chemical profiles. Common essential oils include lavender, eucalyptus, tea tree, peppermint, lemon, and rosemary.

Citrus EOs and its constituent

The chemistry and amount of aromatic oil varies from species to species and also due to climatic conditions. The predominant constituent of citrus oil is limonene (C₁₀H₁₆). Other compounds found in citrus are Myrcene, Linalyl acetate, citral, α -pinene, β -pinene and γ -terpinene. Limonene has a citrus scent and is widely used in perfumes, food flavoring, cleaning products, and aromatherapy. It may offer anti-inflammatory, antioxidant, and anti-cancer benefits.

Methods of Oil Extraction

Plants require different extraction techniques for optimal oil yield. Cold pressing suits citrus peels, while

solvent extraction uses ethanol or alcohol to preserve sensitive compounds. Steam distillation collects oils via steam, supercritical CO₂ extraction retains delicate components with carbon dioxide, and maceration soaks plant material in carrier oil. Cold and hot enfleurage absorb floral scents using fats, which are then washed with alcohol to obtain the oils.

Home Extraction and packaging of Citrus EOs

Homemade CPEO is a rewarding way to utilize citrus fruits completely and incorporate natural, chemical-free alternatives into daily life. A detailed flow chart on two effective methods: cold pressing and solvent extraction, along with important tips have been given (Fig. 1). To get more stronger citrus aroma, increase the soaking/infusion time and quantity of peels. The extracted EOs should be stored in a dark airtight glass bottles at cool and dark place. Always label your container with type and time of oil extraction to track the freshness of your product.

Storage of Citrus EOs

CPEO mostly have a shelf life of six months to one year when properly stored. Always store the EOs at places like cupboards or refrigerator to prevent it from light. So storage in dark bottles with tight seal is recommended. For shelf-life enhancement of citrus oil, add 0.5-1.0 % Vitamin E oil as an antioxidant. This prevent oxidation and degradation of the oil. Storing them in refrigerator also slows down the this process and thus increase the storability of the EOs. Avoid any type of contamination by using clean tools and hands. Following these practices ensures your homemade

citrus oils retain their freshness and effectiveness for optimal use in household applications.

Household application of Citrus EOs

Culinary Enhancements: Homemade citrus oils add bright flavour and aroma to salads, marinades, grilled foods, and desserts.

Aromatherapy and Personal Care: Citrus essential oils work well in diffusers, massage oils, bathwater, and can be added to lotions or masks for skin benefits. Mixed with carrier oils, they hydrate and rejuvenate, help brighten skin, control acne, and offer anti-aging effects, while their scent promotes emotional well-being.

Cleaning Agent and Insect Repellent: Citrus oil naturally cuts grease and grime, makes effective surface cleaners when combined with vinegar or oil, and acts as an eco-friendly insect repellent for surfaces, skin, or clothing.

Fire Starters: Their flammability makes citrus oils suitable for lighting lamps and campfires.

Sustainability and Composting: Citrus essential oils offer antibacterial, antiseptic, and insect-repellent

qualities, serving as sustainable alternatives to chemical products. Leftover material after extraction enriches compost and supports plant health.

Conclusion

Citrus essential oils (CPEO) can be easily extracted at home from oranges, grapefruits, mandarins, lemons, and limes using cold pressing. Recognized as safe (GRAS) when used correctly, these oils offer antibacterial, antiviral, and insect-repellent properties, making them sustainable alternatives to synthetic chemicals. CPEOs are valued in industries like perfumery, cosmetics, food, and pharmaceuticals for their versatility and natural benefits. Quality control and analytical monitoring ensure product reliability. Homemade CPEO can be used in cooking, aromatherapy, personal care, cleaning, and as an insect repellent, but should always be diluted with a carrier oil and patch-tested before skin application due to possible potency and photosensitivity concerns. Use responsibly, considering purity and concentration.



