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Illuminating Focus on The Food Preservation with Different Essential Oils and Their Effects: A Review

[1]Manideepa Mukherjee, [2]Tanushree Paul, [3]Sudeshna Halder and [*4]Manisha Maity

[1]M.Sc., Student, Department of Food and Nutrition, Swami Vivekananda University, Barrackpore, W.B., India.

[2]M.Sc. Student, Department of Food and Nutrition, Swami Vivekananda University, Barrackpore, W.B., India.

[3]M.Sc. student, Department of Food and Nutrition, Swami Vivekananda University, Barrackpore,W.B., India.

[*4]Assistant Professor and Head, Department of Food and Nutrition, Swami VivekanandaUniversity, Barrackpore, W.B., India.

[*]Corresponding e-mail: manisham@svu.ac.in

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Abstract

Essential oils are becoming highly valued these days because of their practicality, therapeutic efficacy, safety, and food preservation qualities, as well as their overall health benefits. The negative consequences of synthetic preservatives in food, cosmetics, and medications are becoming more widely known.

Therapeutic plants are abundant sources of essential oils which are secondary metabolites and volatile in nature. Plant materials such as fruit peels, bark, seeds, flowers, roots, leaves, and wood are used to make essential oils. Some important examples include cinnamon, eucalyptus, thyme, eucalyptus, oregano, clove, basil, lemon, rosemary, and ginger. They have potent antibacterial and food-preservation properties. They contain several active compounds, including terpenes, terpenoids, carotenoids, and curcumin. Especially in the sanitary, cosmetic, food, pharmaceutical and agricultural industries, essential oils are frequently employed for antiviral, insecticidal, fungicidal, bacterial, anti-parasitic, medicinal, or cosmetic uses. Different conventional techniques are employed to extract the oils, including ultrasound- assisted extraction, supercritical fluid extraction, microwave-assisted extraction. Due to their non-toxic properties and numerous health benefits, essential oils as natural preservatives have an advantage over their synthetic counterparts. This review focuses on how essential oils work as food preservatives.

Keywords: *Essential oils, Food preservation, Therapeutic efficiency, Antibacterial, Natural preservatives.*

1. Introduction:

Essential oils (EOs) are secondary metabolites that aromatic and therapeutic plants produce. These oils have numerous uses in the food, fragrance, antimicrobial, and culinary industries. Given the numerous reported harmful effects of synthetic oils, there are some questions about the use of essential oils as antimicrobial compounds and food preservatives. Fruits, vegetables, cereals, grains, pulses, and meals based on pulses can all employ essential oils as a food preservative (Serag et al., 2022). Widely used in the food industry, synthetic preservatives, particularly antimicrobial preservatives, have recently been linked to allergies, intoxication, cancer, and other degenerative diseases, according to new study. Customers discount them as a result, which necessitates the search for alternatives (Laranjo et al., 2017).

In addition, food-borne illnesses are a global public health issue that is getting worse, necessitating the development of better preservation techniques. Numerous studies have been conducted on the antibacterial effects of essential oils and the substances that make them up (Hyldgaard et al., 2012). To encourage the use of Eos in actual food systems, various combinations of edible coatings and EOs will be more effective and focused on their antibacterial effects on various microbes (Ju et al., 2019).

Since they contain a variety of active ingredients with significant roles in the food business, including terpenes, terpenoids, carotenoids, coumarins, and curcumins, essential oils have strong antibacterial and food preservation capabilities. So, in the near future, it may be possible to preserve food commodities utilizing natural, secure, environmentally friendly, economical, renewable, and easily biodegradable antimicrobials thanks to the diverse qualities of essential oils (Pandey et al., 2017).

In view of the current scenario, the present review paper aims to uphold the preservative effects of different volatile and aromatic essential oils in food preservation.

2. Classification of Essential oil on the basis of functional groups:

Groups	Essential oils	Reference
Hydrocarbon	Turpentine, black pepper	(Telange & Pethe, 2013)
Aldehyde	Lemon peel, cinnamon	(Telange & Pethe, 2013)
Alcohol	Peppermint, sandalwood, cardamom	(Telange & Pethe, 2013)
Ketone	Camphor, spearmint	(Telange & Pethe, 2013)
Phenol	Clove, thyme	(Telange & Pethe, 2013)
Ester	Lavender, mustard	(Telange & Pethe, 2013)
Oxide	Eucalyptus, chenopodium	(Telange & Pethe, 2013)
Ether	Nutmeg, anise, fennel	(Telange & Pethe, 2013)

3. Extraction methods of essential oil from plants:

Plant extracts are concentrated forms of bioactive phytochemicals that can be made using a variety of extraction techniques, such as solvent extraction, solvent extraction with or without pretreatment, cold pressing, or steam distillation. In addition to conventional techniques, modern extraction techniques like ultrasonic, microwave, and supercritical fluid extraction have also been researched. Depending on the species and variation, essential oils can also be extracted from various plant components. The goal of extraction is to extract as many bioactive components from plants as possible. Solvents are used to separate the soluble plant metabolites from the insoluble cellular marc. The goods can be utilized in

liquid, semi-solid, dry-powdered, or capsule form after the solvent has been removed (Aziz et al., 2023).

The most popular techniques for extracting antimicrobials from plants are steam hydrodistillation (HD) and steam distillation (SD), while alternative techniques like supercritical fluid extraction (SFE) offer better mass transfer rates and higher solubility. Other techniques include liquid carbon dioxide (LCD) and microwaves (Mihai and Popa, 2013).

3.1 Conventional essential oil extraction methods:

- *Cold Expression:*

The oldest extraction technique, expression or cold pressing, is almost solely utilized to create citrus essential oils. Any physical procedure that causes the essential oil glands in the cuticles and peels to rupture in order to release the oil is referred to as this approach. A watery emulsion is created as a result of this procedure, and the essential oil is then separated from it using centrifugation **(**Stratakos and Koidis, 2016). While a pure essential oil is required, distillation over diluted NaOH or a carbonyl-adduct agent must be used as the EOs produced through cold pressing do not only contain volatile elements; they also contain coumarins, plant pigments, and other substances. Despite the approach's modest yields, it has the benefit of producing little to no heat during the operation (Jurado et al., 2015).

- *Solvent Extraction:*

The dispersion of a solute between two incompatible liquid phases that are in contact with one another is referred to as solvent extraction. In this procedure, a liquid that the material is soluble in is used to transfer the substance from a matrix. The procedure is a type of leaching where the extractable component is as olid, as in the case of plant materials (Jurado et al., 2015). This technique extracts delicate or fragile flower components that cannot be extracted using heat or supplied steam utilizing standard solvents like acetone, petroleum, ether, methanol, hexane, or ethanol. Typically, plant samples are mixed with extraction solvents, the mixture is moderately heated, and the solvents are eliminated and evaporated. This process is more time-consuming and expensive than other procedures since it requires more effort to extract the essential oils (Jurado et al., 2015).

- *Steam distillation:*

The method most frequently employed to extract essential plant oils is steam distillation. Using this method, 93% of the essential oils are extracted, leaving 7% that can still be harvested using different methods. The method started out by heating plant material through steam produced by a steam generator. Heat has a major impact on how effectively the plant substances rupture, disintegrate, and release the volatile elements or essential oils (Aziz et al., 2018).

3.2 Emergent essential oil extraction methods:

- *Microwave-Assisted Extraction (MAE):*

In comparison to other extraction techniques, microwave-assisted extraction (MAE) has been shown to have a number of benefits, including lower costs, faster extraction times, less energyuse, and lower CO2 emissions (Cardoso-Ugarte et al., 2013). In recent years, various researchers have used micro-waves to extract a variety of EOs and reported that the EOs obtained in 30 minutes or less were comparable both in terms of quality and quantity to those obtained using a few traditional techniques, like HD or Soxhlet extraction after more than the double the time (Jurado et al., 2015).

- *Ultrasound-Assisted Extraction (UAE):*

In the phyto-pharmaceutical extraction sector, ultrasound has been recognized as having potential commercial applications for a variety of herbal extracts. In contrast to conventional procedures, by utilizing organic solvents and UAE to separate volatile compounds from organic compounds at room temperature, processing time is shortened, solvent volume is decreased, and extract yield is raised. Its impact is significantly greater at low frequencies (18–40 kHz) and almost nonexistent at 400–800 kHz (Jurado et al., 2015).

- *Supercritical Fluid Extraction (SFE):*

SFE is a technique that has the potential to be used in the industrial sector; it is currently used to extract plant elements like lipids, flavors, and EOs. This emergent extraction method is often speedier, more discriminating about the compounds to be extracted from, and more environmentally friendly than conventional methods. Utilizing solvents in their saturated state, which requires subjecting them to pressures and temperatures over their critical points, forms the basis of SFE (Jurado et al., 2015).

4. Effects of different essential oils in food preservation:

- *Oregano Essential oil:*

The most representative species of this herb's family, the *Lamiaceae*, is *Origanum vulgare*. Because it contains a significant amount of thymol and carvacrol, oregano essential oil has been shown in studies to have the strongest antioxidant power and to have notable effects in reducing fat oxidation. Due to its potent fragrance, which adversely affects the food's organoleptic features, the use of this essential oil as a food preservative is quite restricted. According to reports, oregano essential oils include highly bioactive substances with acaricidal, insecticidal, and perhaps antibacterial properties against bacteria that cause food poisoning and food spoilage **(**Sakkas and Papadopoulou, 2017). *Cypriot pastrami*, a kind of sun-dried beef product also known as samarella, is one food product that uses oregano in food preservation (Veenstra and Johnson, 2019).

- *Clove oil:*

Syzygium aromaticum L., which comprises over 3000 species and 130–150 genera, is a part of the Myrtaceae family, which also includes the myrtle, eucalyptus, and guava families. Its use as an antioxidant is found in bakery products where it lowers the formation of oxidation products and slows down oxidation rates when compared to synthetic antioxidants. As paneer has a short shelf life and is highly perishable, its use is strongly advised (Karunamay et al., 2019).

- *Basil essential oil:*

The popular name for the culinary herb *Ocimum basilicum*, which belongs to the *Lamiaceae* (*Labiatae*) family, is basil. One of the most significant families contains approximately 5,000 species of aromatic and medicinal plants, from which essential oils are extracted and used in a variety of ways. Since it has an antioxidizing action, it has been used in tomato-based goods with high acidity, and as a preventative measure against contamination by bacteria that can withstand acid in foods, particularly in pastries, tinned meat products, and sausages (Sakkas and Papadopoulou, 2017).

- *Ginger oil:*

Zingiber officinale Roscoe, a plant belonging to the *Zingiberaceae* family, is commonly used in folk and traditional medicine as a spice or medicine plant. Ginger's medicinal rhizomes are

used in traditional medicine to treat a wide range of illnesses (Serag et al., 2022). It has been demonstrated that using encapsulated ginger essential oil to preserve foods such as bread, meat, fish, and fruit out performs conventional methods (He et al., 2023). Ginger essential oil (GEO) may be a practical and efficient method for preserving meat (Zhang et al., 2021).

- *Thyme essential oil:*

There are currently 928 species of the genus Thymus in Europe, Northern Africa, Asia, Southern America, and Australia. Thyme is a member of the *Lamiaceae* family.

There is a growing economic interest in this aromatic and medicinal plant, which includes the species *T. serpyllum* (wild thyme) and *T. vulgaris* (common thyme) **(**Sakkas and Papadopoulou, 2017). Thyme (*Thymus vulgaris*) essential oil in capsules is used as a natural preservative in baked goods (Goncalves et al., 2017).

- *Eucalyptus oil:*

There are about 700 species of eucalyptus, and more than 300 of them have leaves that produce volatile oils. Different eucalyptus species' essential oils are used in the culinary, hygiene, cosmetics, and pharmaceutical industries (Marcel, (2018). The utilization of Eucalyptus grandis and Eucalyptus crebra as natural pesticides and food preservatives could be another supporting ecosystem function for the control of pests and diseases (Marcel, 2018).

The growth of yeast (*S. cerevisiae* SPA) in fresh fruit juices was successfully prevented by using eucalyptus essential oil in conjunction with thermal treatment (Tyagi et al., 2014).

5. Conclusion

Due to their antibacterial and antioxidant characteristics, essential oils have become increasingly popular in recent years, keeping food from spoiling. Consumer's view of synthetic preservation is becoming more and more negative, which has increased interest in essential oils and their use in food preservation. The biggest barrier to employing essential oil constituents as food preservatives is that they are frequently insufficiently powerful when used alone and have undesirable organoleptic effects when added in quantities high enough to have an antibacterial impact. In view of the upsurge in the demand for natural preservatives, the present article has discussed the preservative effects of essential oils on foods.

Conflict of Interest: No

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