



## “UNLOCKING THE SKIN BENEFITS OF STAR ANISE: NATURE’S ANTIOXIDANT WONDER”

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### ABSTRACT

This essay explores the potential of star anise (*Illicium verum*) as a valuable botanical resource in skincare. It begins by discussing the historical and cultural significance of star anise and its traditional uses. The chemical composition of star anise, rich in bioactive compounds with antioxidant properties, is highlighted as a foundation for its skincare benefits. The essay delves into the antioxidant capabilities of star anise, emphasizing its ability to combat free radicals and reduce oxidative stress, crucial for maintaining skin health and preventing premature aging. It also discusses how star anise can address various skin concerns, including acne, inflammation, and hyperpigmentation, due to its anti-inflammatory attributes and its role in regulating melanin synthesis. Furthermore, the essay recognizes the potential of star anise in the cosmetic industry, especially in response to the demand for eco-friendly and sustainable skincare solutions. It underscores the need for further research and clinical studies to validate and optimize star anise's effectiveness in various skincare applications. In conclusion, the essay positions star anise as "Nature's Oxidant Marvel" in the skincare domain, advocating for its inclusion in advanced and effective skincare products. This exploration paves the way for further research and innovative product development, potentially integrating star anise into the holistic skincare sector.

**KeyWords:** - Star Anise, Skin Benefits, Antioxidant, Natural Cosmetics, Trans-Anethole, Oxidative Stress, Anti-Aging,

### Introduction

Star anise (*Illicium verum*) is a perennial, evergreen tree characterized by its compact to medium-sized stature. Belonging to the plant family *Illiciaceae*, this botanical specimen is recognized for its distinctive star-shaped fruit. The genus *Illicium* boasts a remarkable diversity, comprising over 42 distinct species and around 166 different varieties. These numerous variations are spread across tropical regions in both East Asia and Southeast Asia <sup>[1]</sup>. The prevalent members within the *Illicium* genus encompass star anise (*Illicium verum*), Mexican anise (*Illicium mexicanum*), Japanese anise (*Illicium anisatum*), and star aniseed (*Illicium anisatum*). The most widely recognized species is star anise, scientifically referred to as *Illicium verum* <sup>[2]</sup>.

Star anise is recognized for possessing a range of advantageous characteristics. These encompass acting as an antioxidant, fighting against microbes, combating fungal infections, expelling parasitic worms, deterring insects, alleviating pain sensations, safeguarding the stomach lining, inducing

relaxation, mimicking estrogen, facilitating the removal of mucus, promoting the thinning of secretions, and relaxing muscle spasms [3]. A reported analysis has revealed that the anise fruit comprises a complex blend of 49 different compounds. Notably, the most abundant compound is trans-anethole, constituting a significant 81.40% of the fruit's composition. Alongside this dominant compound, there are other noteworthy constituents such as limonene, which contributes 6.50% to the overall makeup, and chavicol, present at a level of 2.10%. Furthermore, anisaldehyde has been identified in the composition, making up about 1.81% of the total compounds found in anise fruit [4]. Trans-anethole (TA) was identified as the primary constituent present in star anise essential oil [5]. It is widely employed in the food, perfume, and pharmaceutical sectors due to its pleasant taste and fragrant aroma [6]. Newly Conducted research indicates that trans-anethole holds antioxidant, anti-inflammatory, and anti-obesity attributes, all of which bear significance in the realms of both cosmetology and medicine [7].

The antioxidant protection system substantially enhances the skin's defense mechanism against oxidative damage [8][9][10][11]. Antioxidants are molecules with the capacity to hinder the oxidation of other molecules [12]. These are elements or systems capable of interacting with free radicals and halting a sequence of reactions before vital molecules undergo harm [13]. Antioxidants have diverse uses spanning additional in food, cosmetics, beverages, pharmaceuticals, and the feed industry. Their functions encompass acting as health supplements, active components, and stabilizers [14]. Antioxidants, whether derived from natural origins or created synthetically; find widespread use in the creation of cosmetic products [15].

## **1. MATERIALS AND METHOD**

### **1.1. Extraction of star anise**

Dried fruits of Chinese star anise (*Illicium verum*) were bought from an herb shop in Riyadh, Saudi Arabia [16]. A finely ground powder was produced by processing dried fruits with a grinder. Following that, 100 grams of the powder were immersed in a 500-milliliter solution of 99% methanol, and this submersion was maintained for 24 hours under ambient conditions. Following the 24-hour, the liquid portion above the sediment was isolated and filtered through Whatman filter paper No.1. The solvent was then eliminated, and the resulting dried extract was gathered and preserved as a solution in a refrigerator until needed [17].

### **1.2. Extraction of star anise Essential oil**

Currently, various techniques are employed for the extraction of star anise. These techniques include Soxhlet extraction, steam distillation, ultrasonic extraction, and supercritical CO<sub>2</sub> fluid extraction, among various others [18]. Steam distillation is the widely used extraction process due to the most widely accepted process for large- Scale oil production [19]. The Clevenger apparatus was utilized to perform steam distillation, making use of a 500 ml flask with a rounded bottom [20]. In the upper part of the apparatus, there is a condenser, while the middle section features a cylindrical tube that encloses a collection container with a 15 ml capacity, conveniently marked in 0.1 ml intervals [21].

In a 500 ml flask, a combination of 20 grams of a substance and 200 milliliters of water was placed along with boiling chips. The distillation process continued for a duration ranging from 5 to 8 hours until no additional oil could be gathered. The electrical heater was carefully adjusted to sustain a condensation rate of 18 to 20 drops per minute. The oil sample was left to cool to the ambient room temperature, following which its volume was measured. The yield was quantified as a weight percentage relative to the initial raw material (abbreviated as "r.m."), considering the moisture content [22].

### **1.3. GC –MS Analysis of Star Anise Essential Oil**

The analysis of the essential oil was conducted using gas chromatography, specifically employing a Perkin Elmer Auto XL GC instrument located in Waltham, Massachusetts, USA. This chromatograph was equipped with a flame ionization detector for the analysis and the gas chromatography was performed under the following conditions: a column known as EQUITY-5 with dimensions of 60

meters in length, 0.32 millimeters in internal diameter, and a particle size of 0.25 micrometers was used. Hydrogen (H<sub>2</sub>) served as the carrier gas for this analysis. The gas chromatography conditions involved a column head pressure set at 10 pounds per square inch (psi). The temperature program for the oven consisted of an initial isothermal phase lasting 2 minutes at 70 degrees Celsius, followed by a gradient increase of 3 degrees Celsius per minute until reaching 250 degrees Celsius, where it remained isothermal for 10 minutes. The injection temperature was maintained at 250 degrees Celsius, and the detector temperature was set to 280 degrees Celsius. The process of identifying particular compounds involved comparing their retention times to those of genuine reference samples and aligning their spectral peaks with information found in established reference data <sup>[23]</sup>.

## 2. ANTIOXIDANTS AND THEIR ROLE

Oxidative stress is the result of an uneven ratio between the production of reactive oxygen species, often called free radicals, and the body's capacity to neutralize those using antioxidants. This disparity has the potential to cause harm to tissue <sup>[24]</sup>. Antioxidants are substances that can undergo oxidation themselves, serving the purpose of safeguarding other molecules by absorbing oxidative damage in their place. Antioxidants are substances or mechanisms that possess the ability to interact with free radicals, thereby interrupting a cascading reaction before essential molecules sustain damage <sup>[25]</sup>.

Within the cosmetic industry, natural antioxidants encompass a diverse array of compounds and extracts sourced from a wide spectrum of plants, grains, and fruits. They exhibit the capacity to diminish oxidative stress on the skin or safeguard cosmetic products from deterioration due to oxidation <sup>[26]</sup>. Antioxidants can function as stabilizing agents, proficiently thwarting the onset of lipid rancidity. The process of lipid oxidation takes place not only within cosmetics but also within the human body. Hence, within products incorporating antioxidants, they have the capability to perform multiple functions concurrently <sup>[27]</sup>.

## 3. BIOACTIVE COMPOUNDS PRESENT IN STAR ANISE AND ITS OIL

Trans-anethole, a phenylpropanoid substance, is the main and most prevalent ingredient in the essential oil obtained from the fruit of *I. verum* (star anise). The typical concentration of trans-anethole in the essential oil derived from *I. verum* is approximately in the range of 72% to 92% <sup>[28]</sup>. In addition to trans-anethole, the essential oil obtained from *I. verum* fruit also contains other compounds, including estragole (also known as p-allyl anisole or methyl chavicol), present at approximately 2% concentration, limonene at around 2%, and cis-anethole at roughly 0.5% <sup>[29]</sup>. The essential oil from star anise (*I. verum*) also contains a variety of monoterpenoids, such as  $\alpha$ -pinene, p-cymene, eugenol, linalool, camphene,  $\beta$ -myrcene, trans-ocimene, terpinene-4-ol,  $\alpha$ -terpineol,  $\gamma$ -terpineol, terpinolene, and  $\gamma$ -terpinene. Additionally, it includes sesquiterpenoids like trans- $\alpha$ -bergamotene,  $\alpha$ -copaene, cubebene, cyperene, (+)-9-epilidene,  $\beta$ -elemene,  $\alpha$ -phellandrene, foeniculin,  $\alpha$ -caryophyllene,  $\beta$ -caryophyllene, and  $\alpha$ -muurolene <sup>[30][31]</sup>.

### 3.1. ANETHOLE:-

Formula: - C<sub>10</sub>H<sub>12</sub>O

Boiling point: - 234 °C

Molar mass: - 148.2 g/mol <sup>[32]</sup>

### Antioxidant activity of trans-anethole

The primary constituent of star anise essential oil is anethole, which is also known as 1-methoxy-4-(1-propenyl) benzene <sup>[33]</sup>. Cis and Trans isomers of anethole are also present. Trans-anethole has antioxidant, anti-inflammatory, and weight-loss effects. Trans-anethole has been shown in studies to have free radical scavenging abilities and to support SAO's antioxidant activity. Trans-anethole had potential for scavenging free radical <sup>[34][35]</sup>. Numerous researches compared and validated the antioxidant activity of certain trans-anethole derivatives <sup>[36]</sup>. the key SAO constituents trans-anethole, limonene, and estragole may help laying hens have better antioxidant status. However, there is conflicting evidence about trans-anethole's antioxidant properties <sup>[37]</sup>.

### 3.2. LIMONENE

Formula : - C<sub>10</sub>H<sub>16</sub>  
 Boiling point : - 176 °C  
 Molar mass : - 136.24 g/mol

#### Antioxidant activity of monoterpenoids

Monoterpene’s antioxidant capabilities have been demonstrated [38]. The active components of SAO, including  $\alpha$ -humulene,  $\alpha$ -pinene,  $\beta$ -elemene,  $\beta$ -caryophyllene, limonene, and myrcene, are indeed found in various plant sources, including cannabis and some essential oils [39]. Some of these compounds have been studied for their potential health benefits, including their cytotoxic effects on cancer cells and their antioxidant properties. Limonene exhibited DPPH scavenging activity, catalase and peroxidase-like activities and the potential to protect lymphoma cells from oxidative stress induced by exo-genous addition of H<sub>2</sub>O<sub>2</sub> [40].  $\Gamma$ -terpinene could retard the peroxidation of linoleic acid [41].

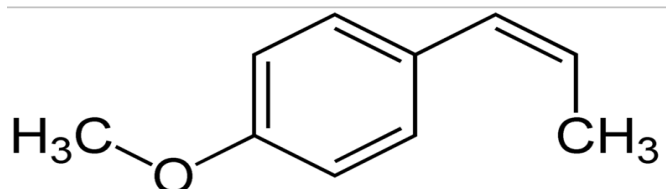
### 3.3. B-CARYOPHYLLENE

Formula : - C<sub>15</sub>H<sub>24</sub>  
 Boiling point : - 245.3 °C  
 Molar mass : - 204.36 g/mol

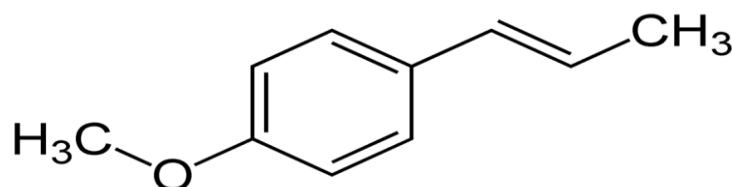
#### Antioxidant activity of Sesquiterpenoids:

Trans-(1, 9)-8-methylene-4, 11, 11-trimethylbicycloundec-4-ene, also known as,  $\beta$ -caryophyllene is a naturally occurring substance found in many different plants and essential oils. B-caryophyllene is a volatile compound known for its limited solubility in water, yet it holds significant potential in the pharmaceutical field due to its abilities to alleviate pain, provide antioxidant effects, combat bacterial infections, and reduce inflammation. The most significant component of sesquiterpenoids with high anti-oxidant properties is  $\beta$ -caryophyllene [42]. In addition to these sesquiterpenoids, there are also trans- $\alpha$ -bergamotene,  $\alpha$ -copaene, cubebene, cyperene, (+)-9-epiledene,  $\beta$ -elemene,  $\alpha$ -phellandrene, foeniculin,  $\alpha$ -caryophyllene,  $\beta$ -caryophyllene and  $\alpha$ -muurolene [43].

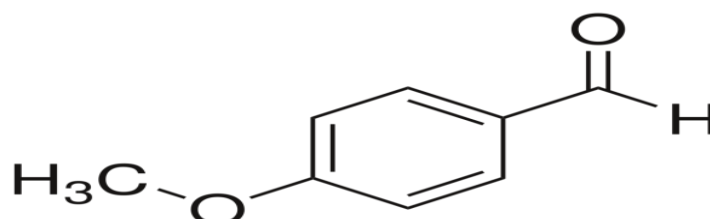
#### (A) Trans-anethole



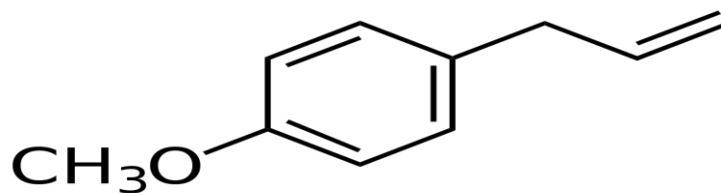
#### (B) Cis-anethole



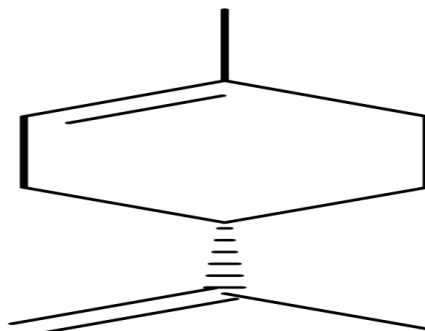
#### (C) p-anisaldehyde



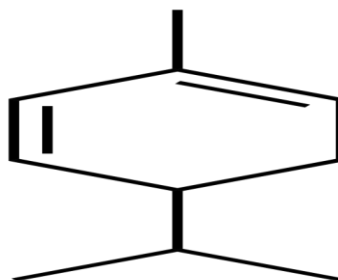
**(D) Estragole**



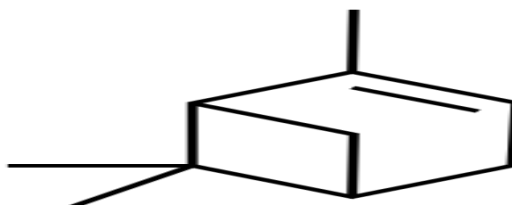
**(E) Limonene**



**(F)  $\alpha$ -phellandrene**



**(G)  $\alpha$ -pinene**



Chemical structures of compounds having anti-oxidant activity: (A) Trans-anethole (B) Cis-anethole (C) p-anisaldehyde (D) Estragole (E) Limonene (F)  $\alpha$ -phellandrene (G)  $\alpha$ -pinene <sup>[44][45][46]</sup>.

#### 4. STAR ANISE OIL BENEFITS FOR SKIN

Skin is a dynamic organ, meaning that it is always in a state of flux. Skin cells are constantly being exfoliated and replenished and will be replaced by new skin cells. Most people's skin flaws, which are problematic to the majority of individuals, whether it be fine lines and wrinkles, age spots, broken capillaries, face discoloration including melasma, or dry/oily or scaly skin., whether it be acne, rosacea, or related disorders. Other issues could include loss of loudness, tone, and texture <sup>[47]</sup>. Due to its high concentration of antioxidants and minerals, star anise has many positive effects on the skin.

Potent phytonutrients and antioxidants found in it do wonders for the skin. Utilizing star anise in skincare regimen can help fight acne, shield against cell damage, lighten dark spots, and minimize the look of wrinkles. One of the spice's most prized aspects and essential to its plethora of uses and therapeutic properties is its high concentration of flavonoids and polyphenols, which is also one of the spice's most valuable. To achieve the best skincare effects, incorporate star anise as a component in skincare routine <sup>[48]</sup>.

#### **4.1. Star Anise Benefits for Skin: Anti Acne**

Antioxidant properties of star anise oil aid in removing germs, reducing inflammation, and soothing skin. Additionally, star anise includes vitamin A, which helps to improve problematic skin issues like acne by controlling oil production, resulting in a more even and less greasy complexion.

#### **4.2. Star Anise Benefits for Skin: Minimizes Wrinkles**

Due to its high antioxidant content, star anise helps to get rid of dangerous free radicals that can lead to oxidative stress in the skin. As a result, the skin seems less wrinkled, is more elastic, and has fewer scars and blemishes, giving it a more youthful, radiant aspect. Additionally, star anise acts as a natural toner due to its anethole and tannins content, tightening the skin for a more toned appearance.

#### **4.3. Star Anise Benefits for Skin: Fades Dark Spots**

Star anise oil is a rich source of antioxidants, vitamins A and C, and other nutrients that help combat free radicals. The antioxidants in star anise help to reduce dark spots and patches while maintaining skin firmness and suppleness by increasing collagen. It has been demonstrated that vitamin C in star anise prevents melanin synthesis. This may facilitate the fading of dark spots and promote even-toned skin.

#### **4.4. Star Anise Benefits for Skin: Soothes and Renews Skin**

Apart from reducing redness, star anise’s vitamin C promotes cellular turnover, replacing damaged cells with healthy ones. Its detoxifying properties, courtesy of anethole, help purify the skin. The tannins in star anise also soothe and tone the skin, improving muscular firmness and avoiding drooping. Additionally, its strong antioxidant activity helps prevent UV radiation damage and lowers early aging symptoms.

#### **4.5. Star Anise Benefits for Skin: Hydrates the Skin**

Star anise oil is a natural skin moisturizer that nourishes and improves your skin's youthful appearance by removing harmful pollutants from the body because of its antioxidant properties. Also have toned, velvety skin as a result of it.

#### **4.6. Star Anise Benefits for Skin: Increase Production of Collagen**

Additionally, higher production of collagen in skin cells is another sign of the star anise oil's benefits. Star anise provides vitamin C. According to a different study, vitamin C can both boost the skin's production of collagen and protect it from the harmful effects of the sun.

#### **4.7. Star Anise Benefits for Skin: Relaxes Facial Skin Muscles**

A unique phenomenon, star anise simultaneously calms and tones skin. When applied topically or consumed as tea, it soothes even the tensest muscles. Its calming effects help to relax the skin muscles. Therefore, when the facial muscles are relaxed and loosen up, wrinkles and fine lines also loosen up and the skin becomes naturally bouncy without the need of harmful chemicals.

#### **4.8. Star Anise Benefits for Skin: Speeds Healing**

Star anise's vitamin A promotes natural moisturizing, which means that daily use can assist to effectively hydrate the skin and give it a bright glow. Vitamin A also supports the skin's immune system, speeds up healing, and prevents breakouts <sup>[49]</sup> <sup>[50]</sup> <sup>[51]</sup>.

### **5. CONCLUSION**

Star anise, once known primarily for its culinary uses, has emerged as a potent botanical ingredient in the skincare industry, thanks to its rich chemical composition, including polyphenols, flavonoids, and essential oils. These components grant star anise remarkable antioxidant properties, offering numerous skin benefits. It can combat free radicals, reduce oxidative stress, address issues like hyperpigmentation and inflammation, and promote an even skin tone.

In conclusion, star anise is a promising ingredient with the potential to revolutionize skincare. It represents a harmonious fusion of nature and beauty, aligning with the growing desire for environmentally responsible personal well-being solutions. The future holds promise for star anise as it takes its place among the stars of the skincare universe.

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