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Role of Essential Oils and Bioactive Components for Manufacturing Cosmetic Items

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ABSTRACT

The cosmetics industry has been forced to search for new active chemicals as a result of increasing customer demand as well as stricter international regulations. Botanical extract offers a source of new active chemicals that is nearly endless and may be used to make cosmetics. Due to their olfactory character in the creation of fragrances and perfumes and the many beneficial properties of their individual components (EOCs), essential oils (EOs) are becoming increasingly popular natural ingredients in the cosmetics and toiletries industry. These properties include anti-inflammatory, antimicrobial, and antioxidant properties (e.g., moisturizers, lotions and cleanser in skin care cosmetics; conditioners, masks or antidandruff products in hair care products; lipsticks, or fragrances in perfumery). It is difficult to generalise the possible applications of essential oils in cosmetics and toiletries because each essential oil has its own unique chemical profile, which is connected with its own particular collection of benefits. Instead, formulators need to make an effort to discover acceptable mixes of essential oils or essential oil compounds in order to get the results they want from the completed goods. This paper presents a detailed examination of the existing research on the usage of essential oils and essential oil compounds (EOs and EOCs) in the cosmetics sector. In addition, we will focus on a few critical topics regarding the safety of essential oils and essential oil compounds used in the cosmetics sector. When formulators of cosmetics are working to perfect products that are based on botanical extracts, they are very likely to find the information offered in this review to be valuable.

GRAPHICAL ABSTRACT

***Keywords*- Cosmetics, Essential oil, Herbal Plants, Personal Cares**.

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I. INTRODUCTION

Since of their many advantages, essential oils and their separated components are extensively utilised in personal care items. [1-2] There is a broad range of biological actions, including analgesic, antiseptic, antibacterial, carminative, diuretic, spasmolytic, hyperaemic, and stimulatory effects. The key reason for their employment in cosmetics is their wonderful perfume. In many situations, the fatty acids, fatty oils, and surfactants utilised in the manufacturing of cosmetics give off an unpleasant aroma. Because of this, effective perfume combinations are added to these products in order to cover up the smell. You can assume that a product comprises fragrance chemicals if it is not clearly labelled as "fragrance-free," "contains no perfume," or "scented-free" [3,4]. On the market, you can find a variety of cosmetic and personal care products with the purpose of cleansing, nourishing, beautifying, and perfuming the human body in order to protect and keep the body in an improved state, as well as to enhance its beauty. [5][6]The EU Cosmetics Regulation, also known as Regulation (EC) No. 1223/2009 of the European Parliament and of the Council of 18 December 2009 on cosmetic products and their labelling, defines cosmetics as "any substance or mixture intended to be placed in contact with the various external parts of the human body (epidermis, hair system, nails, lips, and external genital organs) or with the teeth and the mucous membranes of the oral cavity with a view exclusively or mainly to cleaning, maintaining,Due to the oil's antibacterial and antifungal properties, creams, gels, and ointments that contain an essential oil or a single ingredient as an active agent (for example, rosemary oil or eucalyptus oil) can frequently be used without the addition of a chemical preservative [7][8].

The molecules that make up essential oils are often extremely small, lipophilic, and non-polar. They can penetrate the skin with relative ease and exert their effects there. Friedl et al. [9][10][11] evaluated the amounts of 1,8-cineole in human blood and plasma so that they could investigate the effects of cutaneous and inhalation exposure to 1,8-cineole. Not only did inhalation hasten the onset of the chemical's effects, but it also led to nearly 10 times the amount of the chemical being found in the blood and plasma of the test subjects. It is possible that after dermal delivery of 1,8-cineole, the compound accumulated in the subcutaneous fat, which led to these results. According to the findings of this study, a pharmacological effect is extremely improbable due to the low concentration of terpenoids that can be found in cosmetic products. Because of the growing recognition of the usefulness of essential oils in medicinal and cosmetic products, Lucia Montenegro and her colleagues [12] investigated the topical effects of rosemary oil on skin hydration and skin elasticity in humans. Their research was motivated by the increasing popularity of essential oils. [13] In this study, two different applications of rosemary oil were compared: one used a gel that contained free rosemary essential oil, and the other involved a gel that contained lipid nanoparticles that had been loaded with rosemary essential oil. According to the findings of the study, the oil-loaded lipid nanoparticles were the most beneficial for treating dry and sagging skin. Certain essential oils were shown to have a powerful antibacterial effect against a wide range of dermatological infections by Van Vuuren and colleagues.[14][15]

However, these substances do not only have positive effects; as essential oils and fragrances can be sources of potential allergens, specialists gathered at the international organisation IFRA (International Fragrance Association) defined which essential oils and which components of them represent a potential allergy risk. This was done in light of the fact that essential oils and fragrances can be sources of potential allergens. They also identified the safest concentration to utilise while producing cosmetics [16].

The present study provides an update on side effects and allergy contact dermatitis induced by chosen essential oils and their components that are commonly incorporated to cosmetic- as well as household-products and consequently appear in our everyday lives. Although several essential oils are also recommended in the treatment of specific dermatological diseases due to their activities, the chemicals that are used to boost the scent of a product and/or increase its shelf life were the focus of our investigation. [17]

II. ALLERGIC CONTACT

A wide variety of chemical and botanical components have the potential to irritate the skin. When the skin is subjected to strong chemicals, it may react by turning red, burning, or itching. However, there is a subtype of this condition that is known as allergic contact dermatitis (or just "contact allergies"). [18][19] When this occurs, the immune system has an exaggerated reaction to substances, which can occur even at extremely low concentrations. A few of the most common examples include latex rubber, scented oils and scents, and metals. The severity of allergic reactions to touch might vary greatly. This type of allergic reaction often manifests itself one to three days after exposure, which is a significantly longer latency period compared to many other types of allergic reactions. In addition, contact allergies are the result of extended and repeated interaction with the allergen that causes the reaction. Should this occur, it is possible that some individuals will no longer be able to perform the duties associated with their current jobs. [20][21][23]The removal of the offending substance is the only treatment that has been shown to be effective, and this fact needs to be communicated to all patients with suspected or confirmed ACD. When atopic dermatitis affects less than 20% of the body, the initial therapy of choice is

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topical steroids; if the condition affects more than that, oral corticosteroids are administered. If the ACD is located in a sensitive area, such as the skin folds or the eyelids, topical calcineurin inhibitors or PDE4 inhibitors may be helpful in treating the condition. After the offending material has been discovered, the only approach to prevent subsequent responses is to completely avoid coming into contact with it. [24][25] Taking an antihistamine by mouth, using a hydrocortisone cream to the affected area, or soaking in a cool bath are all potential treatments for allergy symptoms. When vesicles are ruptured, the risk of infection significantly increases. In addition to that, you ought to make use of moisturisers.[26]

In more severe situations, immunomodulators that are given topically, such as tacrolimus, may be helpful. It's possible that some patients will benefit from light treatment combined with ultraviolet A and psoralen. Mycophenolate and other immunosuppressants are only used in extraordinary situations where there is a significant risk to a patient's life. [27][28]

If you have ACD that does not go away even after you have tried other therapies, you might wish to consider patch testing in order to identify the chemical that is causing the problem.[29] In order to have a successful patch test, it is important to have a positive patch test reaction to relevant allergens, patient counselling regarding patch test results, and the selection of appropriate testing chemicals. [30] In addition, the Contact Allergen Management Program (CAMP) that was developed by the American Contact Dermatitis Society can be used to generate a "safe list" of products that do not contain the patient's allergens. These products will not cause the patient to have an allergic reaction. Systemic treatment may be required in situations where there is no way to avoid contact with an allergen. [31] [32]

III. ROLE OF ESSENTIAL OIL IN FRAGRANCE

Oil can be extracted from many different parts of plants, including the leaves, flowers, stalks, seeds, and even the roots.[33][34] Aromatic plants typically have some quantity of volatile oil present, despite the fact that the concentration is not always precisely measured. Roses, on the other hand, are principally responsible for the release of etheric oil at the floral level, in contrast to ginger, which produces more aromatic oil in the rhizome. [35][36]Every single volatile oil is one of a kind, with its very own amazing applications and a variety of possible permutations that are only limited by the scope of nature itself. [37] The aroma of a volatile oil is defined by the chemical makeup of the oil, which changes according to the plant species, harvest time, climate, and region from which the oil is pressed. [38][39] The volatile oil can be smelled when it is heated. [40] There are a broad array of compounds that make up essential oils, and many of these substances have been isolated. [41] There are fewer than 200 different components that can be isolated from the mint oil. A significant chunk of the collection consists of substances that are structurally identical to one another. Cineol, fenchone, limonene, menthol, mentone, pinene, and sabinen are some of the active elements that have been found in plants. Because some of these active elements are found in plants at such minute concentrations, it is nearly impossible to replicate synthetically the laboratory composition of herbal aromatic oils.[42] In light of the fact that all of the chemists in the world, at their current level of expertise, would require thousands of years to correctly synthesise the aromatic essences of plants, it is abundantly evident that nature is the ultimate chemist. Essential oils mostly contain mono- and sesquiterpenes, but they also contain aromatic molecules, which are typically phenylpropane derivatives, and very infrequently diterpenes.[43] Diterpenes are found in essential oils only very rarely (out of a total of 5,000 to 7,000 chemical constituents). Terpenic substances can be any of the following: hydrocarbons, oxygenated derivatives (oxides, alcohols, aldehydes, ketones, or acids), or the reaction products of these substances (esters, ethers). [44][45] Terpenic compounds are a type of organic chemical that can be found in plants; they are a typical component of the molecular stew that results in the production of volatile (essential, etheric) oils. In order to successfully extract aromatic waters and essential oils, one needs access to raw materials, plant products, and quality. [46][47] Before beginning the harvesting process, one must confirm that the plant material has not been tainted by the presence of any other plants by exercising extreme caution. There is a possibility that the plant's soil, as well as its flowers, leaves, stems, and roots, may contain essential oils.[48][49]

Essential oils can have a broad variety of different chemical compositions, but the primary components often fall into one of three categories: aliphatic, aromatic, or terpenic. [50] Ternary compounds are much more common in essential oils than their quaternary counterparts, which are found in much smaller amounts. Products that are volatile include things like terpenes, aromatics, aldehydes, ketones, phenols, volatile acids, and esters, among other things.[51] After harvesting, some plant material that is influenced by hydrodynamics is not processed because of the effects of the hydrodynamics. When using plants when they are fresh, one can acquire both pleasant odour solutions as well as greater therapeutic effectiveness. The only exceptions to this rule are cinnamon, lime blossoms, and lavender flowers, all of which are more effective when used after they have been dried.[52][53] Dry plants can experience morphological and chemical changes that result in urine with a decreased volatile content as a result of the action of air and heat, the buildup of gramme, and the possibility of chemical

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modification. These changes can lead to the production of urine.[54][55] In addition, the technological procedure of extracting volatile oil has a considerable influence on both the chemical make-up of the oil and its overall quality.[56] The hydrodistillation process leads to a series of physical and chemical reactions, which collectively have the effect of radically altering the chemical make-up of the plant material as well as the volatile oil that is subsequently recovered from it.[57] Crushing, chopping, or grinding vegetables properly requires consideration of a number of elements, including the nature of the vegetables and the chemicals they contain. [58] Flowers and foliage are able to pass through the first sieve, but bark and roots, dried fruits, and seeds have to go through the second and third sieves. [59] [60]When fresh fruits are processed into a pulp, this creates a porous material that has the potential to absorb and keep water vapour from the surrounding air. The best vehicle for extractive and distillation dissolution is demineralized water or distilled water that has been recently created and cooled to between 35 and 40 degrees Celsius. There is a wide range of possibilities for the ratio of plant material to solvent, which can range anywhere from 1 to 5. [61] [62] This proportion is impacted both by the quantity of the plant's volatile oil as well as its ability for solubility. A saturated solution of water is drained to remove any undiluted volatile oil that may still be present. [63][64]

IV. APPLICATION OF ESSENTIAL OIL IN COSMETIC

Essential oils are complex mixtures that can contain hundreds of different compounds, each of which can have a unique chemical composition and can be found in varying amounts.[65] The compounds that are present in the highest concentrations are the ones that determine the flavour, scent, and biological characteristics of Eos.[66][67] Essential oils have been used for their advantages to health, beauty, and general well-being since prehistoric times.[68] Over the course of the past few decades, there has been an increase in the level of concern regarding the possible risks that man-made chemicals pose to human health. As a consequence of this, there has been a general upward trend line in the utilisation of natural ingredients to improve the health and beauty of humans. The contemporary cosmetics industry has become an interesting new home for essential oils.[69] The cosmetics sector is responsible for the production of a diverse array of products, including those geared toward skin care, hair care, cleansing, scent, and cosmetic application. [70] The cosmetics and beauty industry is continuously innovating new and improved products for consumers. It is for this reason that cosmeceutical products, which are defined as those that include a bioactive chemical and are marketed as being beneficial to both one's health and attractiveness, are experiencing a rise in popularity.[71][72] Many different kinds of cosmetics can benefit from the addition of essential oils. It is allowed to refer to the plant that was utilised to generate the essential oil by either its common name or its scientific name. When only the common name is provided, it is safe to presume that the essential oil could come from any of the numerous plant species that are closely related to one another.[73] In recent years, essential oils and other EOCs have been increasingly popular choices for inclusion in a wide variety of skin care products. Because of the potential benefits that compounds like these offer in terms of keeping youthful, healthy skin and insulating it from environmental damage [74,75], there has been a recent surge in the use of skincare products that contain compounds like these. EOs have a crucial role in the preservation of healthy skin, both in terms of the microbiota that live on the skin and the protective function that the stratum corneum provides [76]. This is due to the lipophilic nature of EOs. Using essential oils can help lessen the inflammation and scarring caused by acne, which is an added plus. [77] demonstrated that the antibacterial power of citronella grass essential oil against Propionibacterium acnes, its good free radical scavenging activity, and its ability to inhibit the activity of the 5LOX enzyme all contributed to a reduction in the inflammatory processes that are associated with the development of acne. It has been demonstrated that the topical application of Cymbopogan martini essential oil, also known as palmarosa oil, at a dose that is considered to be on the lower end of the spectrum has a significant potential for reducing the symptoms of acne. This is something that Mahant et al. [78] attributed to the role of the oil's primary component. (geraniol). As a consequence of this, tyrosinase activity is inhibited and cytokine levels are reduced, indicating that the substance possesses powerful antibacterial properties. [79] provided evidence that borneol has the potential to be formulated into natural anti-inflammatory skin care products that can replace the use of synthetic anti-inflammatory drugs and antibiotics. These products could be used to treat skin conditions such as eczema, psoriasis, and acne. Researchers Tao et al. [80] looked into the processes that are responsible for the anti-acne effects of artemisin essential oil, which comes from the Artemisia annua plant. Terpenes are beneficial to the skin in a number of different ways, one of which is their capability to suppress the growth of bacteria. These bacteria are known to have a role in the development of skin diseases such as acne and eczema. Additionally, it was discovered that artemisin essential oil has a part in suppressing the hormonal pathways that are linked to the development of acne-related inflammation. This finding was quite exciting.

Nawarathne et al. [81] devised a cosmeceutical formulation for a topical gel to inhibit the development of acne by using the essential oil of Nigella sativa. The following components were included in each one

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hundred grammes of a given formulation: carbopol 940 (1.10 g), phenoxyethanol (1.00 g), glyceryn (3.00 g), polyethylene glycol (0.05 g), Fuller's earth (0.10 g), cetyl alcohol (0.01 g), ethylenediaminetetraacetic acid (0.1), Nigella sativa extract (5.00-15.00 g), triethanolamine, and rosewater These kinds of formulations are very powerful in combating the bacteria that are the root cause of acne; the antibacterial action is enhanced by the presence of essential oils in the product. The formulation that was created as a result is also more effective than previous formulations that used synthetic anti-acne ingredients.

Geranium essential oil has been shown to be effective in treating a variety of skin conditions, including acne, dry skin, sagging skin, dermatitis, and eczema, to name just a few. It is commonly believed that a high concentration of some EOCs, including as linalool, citronellol, geraniol, and geranyl formate, is responsible for this action [82]. The natural suppleness of the skin is helped to be restored by these EOCs, which also aid to increase blood flow to the skin. In addition, geranium essential oil helps to regulate the moisture balance of the skin and promotes the renewal of skin cells, both of which play important roles in reducing the signs and symptoms of acne [83]. In addition, the application of geranium essential oils can help reduce the appearance of a variety of skin spots, such as age spots, red markings, black spots, and spots produced by skin irritation [84].

Table: 1 Some Potential Application of essential oil in skincare Product

Application	Essential Oil	Plant
Anti Acne	citronella grass	*Cymbopogon nardus*
	Artemisin	*Artemisia annua*
	Geranium	*Geranium rotundifolium*
Skin Ageing	rosehip	*Rosa canina*
	lemon	*Citrus lemon*
	Sage	*Salvia officinalis*
Anti-wrinkle	citronella	*Cymbopogon nardus*
	Clove	*Syzygium aromaticum*
Moisturizer	chamomile	*Matricaria chamomilla*
	sandalwood	*Santalum spicatum*

The mechanical properties of the skin barrier, which are closely linked to homeostasis, are associated with the ageing process. This is another aspect of the skin barrier that is affected by ageing. Because of this, any alteration to the typical mechanical barrier function of the skin has the potential to throw off the skin's homeostatic equilibrium. According to De Andrade et al. [85], the utilisation of EOs has the potential to change this latter component. Despite the limited ability of essential oils (EOs) to enter the skin, the researchers found that increasing the thickness of the skin's moisture layer by applying modest concentrations of lavender and sage EOs (in the range of 5-10% w/w) improved the thickness of the skin's moisture layer. When considering the toxicological profile of formulations that contain essential oils (EOs) or their constituents, this final component is particularly important to keep in mind. Essential oils such as sandalwood essential oil, chamomile essential oil, and Hypericum perforatum are only some of the EOs that have been suggested for usage as moisturising agents [86,87,88,89,90]. Rosehip seed oil from Rosa canina is another one of the EOs that has been suggested for use. [91,92] Research has shown that the moisturising qualities of the latter essential oil are due to the high concentration of azulene that it contains. Rose essential oil, on the other hand, has been proven to be the most effective ingredient for preventing the loss of moisture from the skin. Because of this, it is an essential component of formulations designed to keep the skin hydrated, reduce the appearance of fine lines and wrinkles, lighten dark spots, and get rid of acne [93,94]. Essential oils of patchouli and ylang-ylang have also been claimed with having this effect, with the latter helping in tissue regeneration in addition [95,96].

It has also been demonstrated that rosehip seed oil can help reduce the appearance of wrinkles while simultaneously increasing the suppleness of the skin. On the other hand, carrot seed oil contains antioxidant components that can help protect skin from damage caused by UV rays and slow down the ageing process [97]. Its powerful antioxidant properties, which stem from the fact that it encourages the renewal of skin cells, make it one of the most effective strategies for postponing the appearance of wrinkles. Because they increase the body's natural supply of vitamins A and E, flavonoids and carotenoids, which are abundant, are able to reduce inflammation and speed up the healing process for sun-damaged skin. Additionally, the use of carrot seed oil can help reduce the visibility of scars and wrinkles on aged skin, in addition to providing protection from the sun and other forms of free radical damage [98]. Neroli essential oil, which is well-known for the effect it has on the suppleness of the skin, can also be utilised to help reduce the visibility of wrinkles [99,100].

It is possible that the delicate physiological balance that exists between sebum and perspiration may become a major problem for both health and beauty as the human population continues to age. [101] The application of formulations that contain essential oils, on the other hand, has the ability to make a contribution toward the partial alleviation of this kind of condition. Geranium essential oil, which has an alkaline composition, can assist eliminate the excess oil that

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causes pores to become clogged and, as a result, contribute to the maintenance of the skin's natural sebum balance [102]. In a similar vein, the citral found in neroli essential oil has the ability to help maintain the skin's natural oil balance without unnecessarily drying out the skin [103]. Essential oils such as rosemary and ylang-ylang can be used to regulate oily secretions [104, 105], but rosemary oil in particular has a high ester content, which makes it highly effective. Other essential oils such as ylang-ylang can also be utilised.

V. ESSENTIAL OIL WHICH USE AS FRAGRANCE IN COSMETIC CARE PRODUCT

Immortelle

According to the findings of the phytochemical research, the fact that monoterpenes and sesquiterpenes were discovered to be the most prevalent components in the sample of immortelle essential oil that was analysed hints at the possibility that these components could be effective as a wound healing agent. [106] The objective of this study was to produce a wound healing ointment by making use of immortelle essential oil and then test it on diabetic mice that had undergone an excision procedure. We investigated and characterised the pharmaco-technical qualities of an immortelle ointment that had been formulated for topical application. [107] [108] The in vivo wound healing characteristics of ointment were evaluated using a group of 32 diabetic rats that had been given an induced excision wound. Animals were assigned to one of four groups using a random number generator: untreated, treated with 1% silver sulfadiazine topically, treated with the ointment base, and treated with Immortelle ointment. In order to determine whether or not the treatment was successful, researchers turned to observational, biochemical, and histological methods.[109] The shelf life of the ointment that was gentle on the skin was extended to six months. When applied directly to the wound, the Immortelle ointment demonstrated superior performance to that of all other groups in terms of wound contraction and the amount of hydroxyproline it contained. [110] The Immortelle ointment group experienced a significant increase in the rate of wound contraction from day 7 to day 21 when compared to the other groups. On day 21, the wound contraction rate in the Immortelle group was 99.32 percent, while in the control group it was just 71.3 percent, and in the ointment base group it was only 81.2 percent. [111]

Lavender

Concerns about the rate at which wounds such as cuts and scrapes heal are raised in the area of public health.[112] The goal of this study was to investigate whether or not using a nanoemulsion cream that contained licorice extract and lavender essential oil sped up the healing process of a rat model that had suffered a serious skin wound. On the dorsal neck of 85 male Wistar rats, an excisional wound was made, and the rats were then randomly divided into five groups: untreated defects (the negative control), defects treated with vehicle ointment, lavender essential oil, licorice extract in emulsion and nanoemulsion forms, and phenytoin 1%.[113] The untreated defects were found to have the highest mortality rate (the positive control). On days 2, 7, and 14, oxidative stress indicators were detected in wound tissue homogenates using various testing procedures. [114] The levels of TGF- β, type I collagen, and type III collagen genes were all evaluated for their expression. In addition, samples of wound tissue were produced for staining with hematoxylin and eosin as well as masson trichrome. Nanoemulsion was responsible for the greatest reduction in wound area, as compared to the other treatment groups. [115] According to the results of real-time PCR, the expression of the TGF- β 1, Type I, and Type III collagen genes was found to be significantly higher in the nanoemulsion and phenytoin groups than in the other groups.[116] This was the case when compared to the expression levels in the other groups. The levels of lipid peroxidation in the nanoemulsion group and the phenytoin group fell by a sizeable amount, whilst the activity of SOD and GPx increased in a discernible manner.[117] Those individuals who were treated with nanoemulsions and phenytoin generated granular tissue and collagen at a significantly faster pace as compared to the control group and the vehicle group. [118] When an excisional wound model was administered to rats and treated with a nanoemulsion cream that contained licorice extract and lavender essential oil, the animals exhibited promising signs of healing.[119]

German Chamomile

In the treatment of eczema, the volatile oil extracted from German chamomile is used topically. As a consequence of this, we concentrated on the water-oil distribution coefficient, also known as log P, and component content as two essential variables that play a role in determining how well a chemical is absorbed into the circulation. [120] We have determined weight coefficients that are analogous to the signalling pathways that are enhanced by traditional network pharmacology. Using biological enrichment analysis, this can be put to use to reassess the significance of previously identified key pathways.[121] According to the results of a study that compared the contribution scores of the "weight coefficient" before and after ranking, traditional network pharmacology enriched Th17 cell differentiation, the IL-17 signalling pathway, viral protein interaction with cytokine and cytokine receptor, NF-B signalling, and transcriptional dysregulation in cancer. [122] This was discovered by comparing the scores before and after ranking. After recalculating using the new weighting coefficient, the top five enriched pathways were found to be Th17 cell differentiation, chemokine signalling pathway, nitrogen metabolism, and transcriptional misregulation in cancer. IL-17 signalling pathway also

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made the list. [123] Through a combination of research in the relevant literature and pathway sequencing, we came to the conclusion that the differentiation of Th17 cells is an important pathway for the use of German chamomile volatile oil in the treatment of eczema.[124] Both dermatitis and eczema have been connected to an imbalance in the lymphatic T-cell subtypes known as Th1 and Th2. Because TNF- α, which is produced by Th1 cells, induces the synthesis of ICAM-1 and L-selectin, a considerable number of T cells and macrophages penetrate the inflammatory region. In response to inflammatory stimulation, monocytes, macrophages, and endothelial cells all secrete IL-6 that is associated with the Th2 cell lineage. [125] The overproduction of Th2 cytokines is thought to be one of the causes of eczema. On the other hand, the overproduction of Th1 cytokines is thought to make the condition even more severe. People who suffer from eczema have a far higher concentration of Th17 cells in their blood than healthy people do, and these cells release a number of inflammatory cytokines that make the condition worse. When Th17 cells release IL-17, which activates keratinocytes, the inflammation and tissue breakdown that can occur in the skin can become more severe. [126] When compared to the control group, the serum levels of the pro-inflammatory cytokines TNF- α, IL-6, and IL-17 were lower in mice that had been treated with German chamomile volatile oil. This finding suggests that one of the anti-inflammatory mechanisms at action here is the reduction of these levels. After IL-17 binds to cell surface IL-17 receptors and activates downstream signalling pathways such as NF-kappaB and MAPK, the expression of pro-inflammatory chemokines and cytokines is increased. This results in an increase in the production of these cytokines and chemokines. [127-128]

The seeds of the plant Carthamus tinctorius, more commonly referred to as safflower, can be processed to extract oil. The majority of the fat is composed of linoleic acid, which accounts for around 70% of the fat, oleic acid, which accounts for approximately 10% of the fat, and stearic acid, which accounts for approximately 5% of the fat. Safflower has been shown to be beneficial as both a pain reliever and a fever reducer, according to a number of scientific studies. Recent pharmacological studies have shown that safflower extracts have a variety of physiological effects, including anticoagulation, vasodilation, antioxidantism, reduction of melanin formation, immunosuppression, and anticancer activity. Safflower extracts have also been shown to reduce the formation of melanin. It has been demonstrated that flavones present in low micromolar concentrations, such as luteolin and its glucopyranoside, has anti-inflammatory activities [79,80,121]. This anti-inflammatory effect can be explained by the fact that inhibition of NF-kB activity [80] takes place. The fatty acid components of plant oils that are utilised in topical applications have the potential to affect the fatty acid profiles of an infant. According to studies carried out by Solanki and colleagues [122], safflower seed oil that is applied topically is readily absorbed by infants. When safflower oil was applied to the skin, it caused an increase in the amount of linolenic acid and arachidonic acid found in the body [122]. Changes in fatty acid profiles may be of therapeutic consequence if there is a correlation between the metabolism of polyunsaturated fatty acids (PUFA) by skin epidermal enzymes and the synthesis of anti-inflammatory compounds, according to a theory that has been proposed [129].

Argan Oil

Argan oil is obtained by crushing the seeds of the Argania spinosa L. tree, which is recognised by its scientific name. There are also some saturated fatty acids found in argan oil, although they make up only around 20% of the total. The majority of the fatty acids in argan oil are monounsaturated. There is evidence of the presence of squalene, as well as triterpene alcohols, polyphenols, tocopherols, and sterols. Since ancient times, argan oil has been utilised in the kitchen, as a treatment for various skin conditions, and as an ingredient in hair, skin, and nail care products. It has been discovered that argan oil can repair the barrier function of the skin and keep its capacity to hold water, which ultimately results in enhanced elasticity [130] and hydration [131]. In addition to these benefits, it has been demonstrated that topical therapies can have a soothing impact on the skin, which helps in the accumulation and transdermal transfer of topical drugs such allantoin [132]. Tocopherol-rich argan oil nanoemulsions that are based on argan oil have recently been created as carriers. These nanoemulsions have anticancer effect in murine breast and colon carcinoma cells [134]. Furthermore, it has been established that argan oil can ameliorate WH-induced second-degree burns in rats [135].

Soybean Oil

Soybean oil is the name given to the oil that can be obtained by pressing the seeds of the Glycine max plant. Extracts of soybean oil have been the subject of the overwhelming majority of research conducted in the scientific community. Forearm skin TEWL can be decreased when soybean oil extracts are applied topically [136]. This could be because of the phytosterols included in soy, which have been shown to aid in the mending of damaged skin barriers [137]. Because the seed coat contains anthocyanins, black soybeans, on the other hand, have been shown to have anti-human tyrosinase activity as well as antioxidative activity [138]. This is due to the presence of these compounds in the seed coat. Black soybeans contain anthocyanins, which are known to reduce inflammatory responses. These anthocyanins do this by inhibiting the production of reactive oxygen species (ROS) and mitogen-activated protein kinases (MAPKs), which are essential for the signalling of lipopolysaccharide-stimulated macrophages [139]. When applied topically,

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soybean oil can lessen the severity of sunburn produced by ultraviolet B rays [140].

Peanut Oil

Peanut oil has been shown to have a hydrating effect on human skin without significantly increasing trans ectodermal water loss (TEWL) [141]. Peanut oil applied topically shields the skin from the damaging effects of UV rays [142]. In a similar manner, Lasne et al. [143] found that mice that were topically treated with peanut oil inhibited the development of chemically-induced skin cancer. As the number of people who are allergic to peanuts continues to climb, there has been a recent uptick in the number of questions asked about the safety of topical therapies that use peanut oil. Nonetheless, research [144,145] has demonstrated that the formulation with refined peanut oil is safe for topical use, even for people who are allergic to peanuts. [146,126]

Sesame Oil

To make sesame oil, the seeds of the Sesamum indicum plant are crushed and pressed together. Over the course of the past six thousand years, sesame oil has been utilised in a myriad of different ways to prepare food. Sesame seeds contain a significant amount of the lignan sesamin, as well as sesamolin and sesaminol, which are all rich in antioxidants [145]. Sesamin is quite hydrophobic to the extreme. There was shown to be a favourable correlation between the oil content of sesame seed and the sesamin content of oil [146]. According to the findings of a recent study [147], the use of sesame oil may help minimise the oxidative stress that rats experience by inhibiting the release of xanthine oxidase and nitric oxide. In traditional Taiwanese medicine, oil that is produced from sesame seeds has been used for a very long time to alleviate inflammatory pain, particularly the kind of pain that is connected with joints and wounds. Patients who had suffered limb injuries have discovered that receiving a massage with topical sesame oil significantly lessens the intensity of their discomfort [148]. Oral administration of sesame oil was found to be effective in reducing acute inflammation in a rat model of pseudosynovial cavity that was brought on by monosodium urate (MSU) crystals [92]. Patients with limb injuries who applied sesame oil to the affected area reported reduced pain and required less NSAID medication, according to the findings of a clinical experiment conducted by Shamloo et al. [149]. When used topically, sesame oil protects the skin from the damaging effects of ultraviolet radiation. In addition, a two-stage carcinogenesis model of skin cancer in mouse subjects revealed that sesame oil possessed chemopreventive efficacy. It has been demonstrated that sesamol, one of its constituents, can help prevent cancer [150].

Avocado Oil

Avocado oil is extracted from the fruit of the Persea americana tree, also known as the avocado tree. The percentage of oleic acid in avocado oil can be anywhere from 31.8% to 69.6%, while the percentage of linoleic acid can be anywhere from 6.1% to 22.9% and the percentage of linolenic acid can be anywhere from 0.4% to 4.0%. As well as the vitamins A, C, D, and E, this food also contains the minerals as well as beta-sitosterol, lecithin, and beta-carotene [151]. Because it contains a high concentration of nutrients, it assists in the restoration and rehydration of dry, injured, or chapped skin [152]. The administration of avocado fruit extract topically to rat wound models has been demonstrated to improve healing times and raise levels of the structural protein hydroxyproline, according to research [153]. It has also been demonstrated that administering avocado oil topically to rats throughout the WH process leads to an increase in collagen synthesis and a reduction in the total number of inflammatory cells [154,155].

Borage Oil

Borage oil is extracted from the seeds of the *Borago officinalis* plant, which gives the plant its name. Borage oil is rich in the essential fatty acids of the omega-6 family, which play a pivotal role in maintaining healthy skin [156]. The presence of linoleic acid in borage oil makes it an effective treatment for Alzheimer's disease. It has been shown that the skin barrier function can be restored using borage oil in patients with seborrheic dermatitis or atopic dermatitis [157]. Borage oil is safe for use on babies and children. The clinical effects of borage oil–coated undershirts on children with AD were examined in a trial that was controlled by a placebo and conducted with double blinding [158]. TEWL on the skin of the back was found to be lower in the group that was treated with borage oil. In addition, there was no indication that any unfavourable outcomes were being experienced by these patients [159].

Jojoba Oil

The jojoba plant, also known as Simmondsia chinensis, is a perennial that thrives in arid environments for extended periods of time. Jojoba oil possesses extraordinarily high levels of both oxidative stability and degradability [160]. Jojoba oil is a component in a wide variety of best-selling cosmetics and toiletries for the face and body, such as moisturisers and sunblocks. [161,162,163] There is evidence to suggest that it assists the body in absorbing topical drugs. Due to the high wax ester content in jojoba oil, it can be used as an efficient treatment for barrier repair in dermatoses such as seborrheic dermatitis, eczematous dermatitis, atopic dermatitis, and acne vulgaris [164]. Additionally, it has been demonstrated that jojoba oil possesses an anti-inflammatory function, which positions it as a potential treatment for a wide variety of skin conditions, including infections, ageing, and WHO [165,166].

Oat Oil

Oat oil comes from the seed of the *Avena sativa* plant. In comparison, the oleic acid concentration ranges from 28–40% [167], linoleic acid content ranges from

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36–46%. Oatmeal, in the form of colloidal oats, has been used as a topical treatment for a wide variety of skin conditions, including skin rashes, erythema, burns, itching, and eczema, for hundreds of years. It has been demonstrated that oleic acid can breach the barrier that protects the skin [168], yet the high quantity of linoleic acid found in oat oil (36–46%) may help rebuild the barrier in the long run [169]. The anti-oxidant and anti-inflammatory characteristics of oat extracts found in colloidal form may be directly responsible for the efficacy of lotions that contain colloidal oats [170]. Avenanthramides are a type of phenolic compound that can be found in oats. The synthesis of cytokines can be inhibited by avenanthramides, which in turn helps reduce inflammation [171].

Oat oil has been shown to increase the expression of genes involved in both the processing of ceramides (-glucocerebrosidase, sphingomyelinases 3, and ABCA12), as well as the differentiation of keratinocytes (e.g., involucrin, small prolin-rich protein family (SPRRs), and transglutaminase, when tested in vitro. In addition, it was shown that treatment with oat oil in keratinocytes activated peroxisome proliferator-activated receptors (PPARs), which resulted in a significant increase in ceramide levels (70 percent) [172].

Pomegranate Seed Oil

The fruit of the plant known as Punica granatum is what's utilised to make the oil of the same name. It is rich in several elements that are helpful to the body, including phenolic compounds, phytosterols, lipid-soluble fractions, and FFAs [173]. Linoleic acid makes up 29% of the total fatty acids in pomegranate seed oil, while oleic acid only makes up 10% of those total fatty acids [174]. The extensive use of pomegranate seed oil can be attributed to the fact that it contains a high concentration of polyphenolic components and also has anti-inflammatory and antioxidant effects. The use of an oil-in-water lotion containing pomegranate seed oil and C. lechleri resin extract has been shown to be effective in either preventing the skin changes associated with striae or improving their appearance [175]. In order to provide the polyphenols that are contained in pomegranate peel, nanoemulsions that include pomegranate seed oil have been produced [176].

Ketoprofen's photostability and in vivo anti-nociceptive action were shown to be improved in nanoemulsions that also contained pomegranate seed oil, according to research published in [177]. Researchers found that a topical application of pomegranate seed oil at a concentration of 5% significantly reduced the incidence of tumours and the level of 12-O-tetradecanoyl-phorbol-13-acetate (TPA)-induced ornithine decarboxylase activity in CD1 mice that had been given a skin cancer model that was chemically produced. Because of this, oil extracted from pomegranate seeds has been suggested for use as a chemopreventive agent against skin cancer [178].

Rose oil

Rose oil comes from the Rosa x. damascene Mill. plant, which was originally brought to Europe from Damascus and is more often known as the damask rose. In the research that was done, several different types of roses were mentioned as possible origins of rose flower essential oil. These roses were *R. canina*, *R. centifolia*, *R. galica*, *R. moschata*, and *R. rugosa*. R. damascene is the primary source for most commercial rose oil and the primary component in the rose oil that is exported from Bulgaria and Turkey, which are the world's two largest producers of rose essential oil. Although there are a few species of roses that can be used to generate rose oil, R. damascene is the primary source for most commercial rose oil. Rose oil is used as a flavouring agent in many different kinds of food, such as jam, ice cream, pudding, and yoghurt, and as a fragrance in many different kinds of cosmetic items. Jam, ice cream, pudding, and yoghurt are a few examples of the types of food that contain rose oil (soaps, body lotions, face creams, etc.) [179].

Investigated how the essential oil concentration and overall composition of R. damascene changed depending on the storage conditions that were used. The authors propose utilising freshly plucked petals in order to acquire the highest possible grade essential oil from the plant. Due to the fact that it is impossible to distil a substantial quantity of petals all at once using steam, the composition of the rose oil may have undergone some subtle transformations as a result of the numerous fermentation processes that were place before it was distilled. Because it is preferable to maintain dryness in the petals until they are ready to be distilled, freezing them is a vital stage in the process.[180]

R. damascene possesses a wide range of beneficial pharmacological properties, including those of an analgesic, anticonvulsant, antidiabetic, antibacterial, anti-HIV, anti-inflammatory, and antioxidant agent. In traditional Persian medicine, the essential oil of R. damascene has also been used to treat male sexual dysfunction and to stimulate desire. It is believed that the lipophylic components of R. damascene were the primary source of the majority of these effects [181].

This is due to the fact that it possesses antibacterial properties, which make it exceptionally effective for treating acne as well as for moisturising dry skin. To begin, rose oil has the ability to hydrate the skin while simultaneously killing the bacteria that cause acne. [182] After utilising rose essential oils, four people, three of whom were aromatherapists and one of whom was a chemist with an interest in aromatherapy, developed an unpleasant contact dermatitis. At a concentration of 2% Bulgarian rose oil, each of the four test subjects showed signs of having a good reaction to the oil [183]. After applying a patch, most people who came into contact with the essential oil reported having a positive reaction. Geraniol and citronellol are two of the most prevalent allergens that people are sensitive to [184].

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VI. ALLERGENIC CHARACTERS AND TOXICITY OF EOS IN COSMETICS

The beauty industry, the home goods industry, and the food and beverage industry are just some of the many sectors that benefit greatly from the use of fragrances. There may be anywhere from ten to three hundred of these chemicals present in a given product. The exact amount can vary. The greatest number of components can be found in perfumes, which can have as many as 2,000 distinct components (in perfume extract). The perfume business makes use of around 3,000 distinct flavours, all of which are either extracted from natural sources or manufactured in a laboratory [185]. Due to the large variety of chemicals that are used in the production of cosmetics, testing for contact allergies requires the use of a combination of the aroma compounds that are the most allergenic. In order to determine whether or not a person has an allergy to fragrances, a professional will often use a scent mix that contains eight distinct odours. It is possible to achieve comparable results when using balsam of Peru for patch testing [186]. The FM test can reveal olfactory hypersensitivity in as many as 70% of allergic patients, according to some research [187], but the majority of investigations have found that this percentage is closer to 30% [188-190]. These include cinnamic aldehyde and alcohol, eugenol and isoeugenol, geraniol, hydroxycitronellal, amyl cinnamaldehyde, and oak moss. Other components include eugenol and isoeugenol. In a study conducted in Denmark, just a fraction (5.5% to be exact) of eczema patients who were given the mixture experienced a positive reaction to it. Oak moss and isoeugenol, both of which are found in expensive perfumes and deodorants, have both been called for the prohibition of adding them to cosmetics in the European Union [191]. This is due to the high number of people who are allergic to these ingredients. Oak moss and isoeugenol are both included in deodorants. There was also an attempt made to use the acetate of isoeugenol as a replacement; however, the outcomes were unsatisfactory [192]. In addition to its use as a fragrance component in a wide range of cosmetic products, balsam of Peru is valued for its ability to fix fragrances. The name given to this product is derived from a mixture of at least a dozen allergens, some of which are cinnamic aldehyde and acid, cinnamic cinnamon, cinnamon benzoate, benzyl benzoate, vanillin, vanillic acid, nerolidol, and farnesol. Other allergens include cinnamic acid and cinnamic aldehyde. Because of its intricate make-up, utilising balsam of Peru [193] carries with it a significant risk of experiencing unfavourable reactions. It has been found that 5%-14% of those who suffer from eczema also have sensitivity to the scents of cosmetics [193]. On the other hand, it is estimated that between 1% and 6% of the general population has a sensitivity to perfumes. The hypersensitivity to fragrances most frequently presents itself as allergic contact dermatitis, contact urticaria, or phototoxic reactions. These changes can take place in the skin on your hands, face, neck, or armpits [194,195].

19 of the 50 people we studied were male (representing 38% of the total), whereas 31 were female (representing 62% of the total). There were 1.63 males for every one female in the population. In our study, there were more females than males, which is in line with the overall population of persons who develop allergic contact dermatitis after using cosmetics [196], where females are more likely to be affected than males. The ages of the participants in the research study ranged from 13 to 67 years old. According to the findings of a study conducted by Adams and Maibach [197], patients who experienced aesthetic reactions were more frequently encountered between the ages of 20 and 60. In this particular research endeavour, participants who were between the ages of 21 and 40 made up the largest age group, accounting for 58% of the total. The age bracket of 41-50 years old contained the biggest percentage of men (31.58 percent), whereas the age bracket of 21-30 years old contained the largest percentage of women (38.71 percent). This may be due to the fact that the majority of the males who participated in the study had an allergy to the hair dyes that they had only recently begun using after the age of 30.

According to the findings of de Groot et al. [198], erythema was the objective symptom that was reported the most frequently (61%) followed by scaling (19.3%) and pimples (14.2%). When we looked at the objective symptoms, erythema was the most common, accounting for 52% of the cases. Papules came in second with 40%, and scaling took third place with 34%. Plaques (at 20%), macules (at 18%), vesicles (10%), and pustules (at 6%) were also prominent early lesions. The most common secondary lesions were hyperpigmentation (28%), crusting (12%), hypopigmentation (10%), and excoriation (10%). Hyperpigmentation was the most common.[199]

The overwhelming majority of men (84.21%) and women (100%) said that soap was their primary method of personal hygiene and aesthetic care. In addition, there were items such as bindi, sindoor, and kumkum (32 percent), shampoo (64 percent), perfume (38 percent), and facial creams (50 percent). Over seventy percent of the sample's female participants used face cream, while just 52.63 percent of the sample's male participants coloured their hair.[200]

According to the findings of a number of studies [201], the vast majority of instances of contact allergy to cosmetics are brought on by skin care products (moisturising and washing cream/lotion/milk). The results of our research suggested that face creams (at a rate of 20%) were the most common cosmetics responsible for allergic contact dermatitis. Other common types of cosmetics that triggered allergic reactions included shaving cream (10%), perfume (8%),

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shaving cream (10%), and hair dye (14%). On the other hand, females were more likely to have encountered irritation from face cream, soap, perfume, and lipstick, while males were more likely to have had irritation from hair dye, shaving cream, and perfume.[202] The most frequently reported allergic reactions to cosmetics are to the products' fragrances and preservatives. According to the findings of our study, the antioxidant gallate combination is the allergen that is most commonly encountered. The results were positive in forty percent of the subjects. It is possible that the antioxidant propyl gallate, which is frequently discovered in skin creams, is to blame for this phenomena. According to the results of patch testing, common allergens detected in cosmetics include cetrimide (present in 28 percent), thiomersal (20 percent), and paraphenylenediamine (14 percent).

In the instance of 31 patients, the patch test also contained the potentially responsible cosmetics. Testing was done on the cosmetics in their "as is" state. It was determined that 22 of the patients, or 71%, had developed cosmetic contact dermatitis. Patch testing with possibly allergic cosmetics had positive results for fifty percent of the patients, according to Mehta and Reddy [203]. In spite of the fact that these four individuals had a positive reaction to one or more antigens from the cosmetic series, the suspected cosmetic product did not cause any problems for them. A patch test may not have been able to detect a reaction because the antigen in the cosmetic did not exist in sufficient quantity to do so. This is one of the possible explanations.

In a study on allergic reactions to cosmetics that was carried out by Dogra et al. [204], the researchers found that out of a total of 2065 patches that were tested, 3.2% of those patches responded positively to a basic cosmetic kit, and 3.3% of those patches responded positively to a variety of cosmetics. Our research found that there was a favourable reaction rate of 3.75% (95/2531), out of a total of 2531 patches that were applied. According to the findings of a study that was carried out in Seoul, it appears that patch test kits may not contain all of the antigens that are found in cosmetics, which means that some allergies may go untreated. Researchers in India conducted studies on children with contact dermatitis and found that certain youngsters may be susceptible to cosmetic antigens. This sensitivity may develop at a young age as a result of continuous usage of cosmetics. Because citrus is a chemical that is frequently used in the fragrance industry, people who have a positive reaction to a fragrance combination ought to be tested for its presence [205] [206] [207].

VII. CONCLUSION

Essential oils are an essential component of the perfume and cosmetics industries because of their versatility as chemical preservatives (in a natural or natural-like way) and scent compounds (which can have a number of beneficial effects on the skin and body). Essential oils are also used in aromatherapy. The value of cosmetics is also increased by the pleasant aroma that is produced by these compounds, which contributes to the value of cosmetics overall. Because of this, the industries of cosmetics and perfume would cease to exist in the absence of these scarce and priceless chemicals. Essential oils are excellent, but it is vital to keep in mind that certain people may be allergic to them or the compounds that they contain. Essential oils contain a variety of different components. The academic literature often provides insights that can be interpreted in this manner. According to the research conducted by de Groot and Schmidt, 79 different essential oils have been connected to contact allergy or allergic contact dermatitis. This number is expected to rise to 2022. Many studies were performed on individuals with an above-average allergic potential or on patients suffering from dermatitis or other cutaneous disorders; nonetheless, the majority of the articles found only isolated instances of allergy contact dermatitis caused by essential oils. It is possible for these individuals to put themselves in harm's way by using cosmetics or perfumes that contain allergens. It is crucial that products that may contain allergens be properly labelled as such so that individuals who have sensitive skin can avoid purchasing products that may include allergies. At every stage of the distribution process, meeting the storage and handling requirements for products that contain fragrance compounds is essential.

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