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Review

Alternative of Herbal Preservatives

Venkatesh. S, Vinoth Kumar. S, Nandha Kumar, Karthick. S, Vigneshwaran L.V

Department of Pharmaceutics, RKP College of Pharmacy, Krishnagiri, Tamilnadu, India

*Author for Correspondence: Vigneshwaran L.V,
Email: vigneshwaran85@gmail.com

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Abstract

The cosmetic industry is witnessing a paradigm shift toward the integration of natural ingredients, particularly in the selection of preservatives. Conventional synthetic preservatives, though effective, have raised concerns regarding potential health risks and environmental impact. This review highlights various natural alternatives to synthetic preservatives in cosmetic formulations, with a focus on essential oils, plant extracts (Neem, Curcumin, Aloe vera), and raw materials like honey. These natural agents exhibit significant antimicrobial, anti-inflammatory, and antioxidant properties, making them promising candidates for preserving cosmetic products. Essential oils such as Thymus onites and Cinnamomum zeylanicum demonstrate strong antimicrobial action, often surpassing synthetic preservatives in efficacy. Similarly, plant-based substances like Neem and Curcumin offer broad-spectrum antimicrobial effects and additional therapeutic benefits. Honey, known for its historical use in skin care, contributes both humectant and antimicrobial properties. This review underscores the importance of these natural preservatives in promoting safer, eco-friendly cosmetic formulations.

Keywords: Alternative, Herbal, Preservatives, Cosmetics, Types of Preservatives, Antimicrobial

INTRODUCTION

Herbal cosmetics are defined as formulations intended to improve human appearance. The term Herbal Cosmetics, as utilized in this context, refers to products that are crafted using a range of permissible cosmetic ingredients to establish a base, into which one or more herbal elements are integrated to provide specific cosmetic advantages exclusively, and will be identified as "Herbal Cosmetics".(1) The origin of cosmetics was associated with hunting, fighting, religion and later associated with medicine.(2) Cosmetics are products designed for use on various external parts of the human body, including the skin, hair, nails, lips, and external

genital organs, as well as teeth and mucous membranes in the oral cavity. They serve purposes such as altering a person's appearance, cleaning the body, perfuming the body, maintaining skin health, addressing body odor, and providing skin protection(3) preservation is essential to prevent microbial growth in cosmetic products. Preservatives are added to inhibit the growth of bacteria (both gram-positive and gram-negative), yeast, and mold, which can spoil the product and potentially lead to skin infections or other health issues when applied to the skin. Properly preserved cosmetics are safer for consumers to use(4) Safety is paramount when selecting preservatives for cosmetic products, as they must be safe for human health. Primary contamination typically occurs during the manufacturing process, where impurities or microorganisms can inadvertently get introduced. This emphasizes the need for strict quality control and hygiene during production. Secondary contamination, on the other hand, can happen when consumers use the product. For instance, when fingers or applicators come into contact with the product, they can introduce bacteria from the skin into the product. This highlights the importance of user education and proper product handling to minimize the risk of secondary contamination. Preservatives in cosmetics serve the critical role of reducing the risk of microbial contamination in the product. They help maintain the product's safety, quality, and efficacy throughout its shelf life and during its use by consumers. This is crucial for ensuring that cosmetic products remain suitable and safe for the intended purpose(5) Cosmetics, as outlined in the Drug and Cosmetics Act, refer to products designed to be applied to the human body or any of its parts through rubbing, pouring, dusting, or spraying, with the intention of cleansing, enhancing beauty, increasing appeal, or changing one's appearance.(6)

TYPES OF PRESERVATIVES

1. Natural preservative:

Essential oil

Plant extract

- Neem
- Curcumin
- Aloevera

Raw material:

- Honey

2. Chemical (or) synthetic presertative :

- Phenoxyethanol
- Benzyl Alcohol
- Potassium Sorbate
- Paraben

NATURAL ALTERNATIVE PRESERVATIVES

Natural preservatives, often referred to as botanical preservatives or plant-based antimicrobials, are sourced from plant extracts, essential oils, and other sustainable materials. These components have natural antimicrobial characteristics, positioning them as viable substitutes for conventional synthetic preservatives(7). Increasingly, consumers are wary of the possible health hazards and ecological effects linked to the synthetic preservatives frequently found in cosmetics(8).

ESSENTIAL OILS

Currently, essential oils are the focus of extensive scientific investigation and are also gaining interest from the cosmetic and pharmaceutical sectors because of their potential as active pharmacological agents or natural preservatives. The vast diversity of these natural compounds, along with their broad range of biological properties, renders them appealing to various industries, and there are still unexplored areas of application. Apart from their sensory attributes, the primary research objective is to understand their antimicrobial and antifungal effects.(9)

A comparative analysis of the preservative effectiveness of herbal extracts, essential oils (*Lavandula officinalis, Melaleuca alternifolia,* and *Cinnamomum zeylanicum*), and *methylparaben* indicated that essential oils exhibited greater inhibitory action compared to synthetic preservatives and extracts in cosmetic emulsions. Cinnamon oil (2.5%) proved to be the most effective in preventing the growth of S. aureus, E. coli, and C. albicans. (10)

The antimicrobial effectiveness of essential oils (2.5%) was, in some instances, 3.5 times greater than that of *methylparaben* (0.4%), depending on the microorganism strains tested. This research demonstrated that essential oils might replace synthetic preservatives, even though they need to be used in higher concentrations. A recent study on an antimicrobial emulsion that incorporated collagen hydrolysate revealed that an emulsion containing 2% Thymus onites essential oil was effective against the tested bacteria and fungi, as assessed by the diffusion method.(11)

PLANT EXTRCT

NEEM

Every part of the neem tree possesses various medicinal properties. The non-woody components of Neem, including leaves, bark, oil, flowers, fruits, and seeds, exhibit significant qualities such as being antiallergic, antifungal, antibiotic, antidermatic, antibacterial, anti-inflammatory, insecticidal, larvicidal, antimalarial, and antiulcer, along with other biological activities. Certain water-soluble extracts of Azadirachta Indica hold considerable importance in managing hyperglycemia, hypolipidemia, and hypotensive effects.(12)

Neem extracts and their various constituents significantly contribute to the suppression of a range of microorganisms, such as viruses, fungi, and bacteria. The methanol and chloroform extracts from Azadirachta indica were selected to test their antibacterial properties against Escherichia coli, Proteus vulgaris, Klebsiella pneumoniae, Bacillus subtilis, Micrococcus luteus, Streptococcus faecalis, and Enterococcus faecalis. The results indicated that the methanol extract had the most substantial efficacy, the chloroform extract showed moderate effects, while the hexane extract exhibited very low antibacterial activity.(13)

Neem is commonly utilized in medicinal and pharmaceutical applications. The bark and stem of Neem exhibit significant antibacterial properties against Klebsiella, Serratia species, and Streptococcus. The methanolic extracts from Neem demonstrate antibacterial effects on Vibrio cholera, while the chloroform extracts target E. coli, Bacillus subtilis, Enterococcus faecalis, and Streptococcus faecalis.(14)

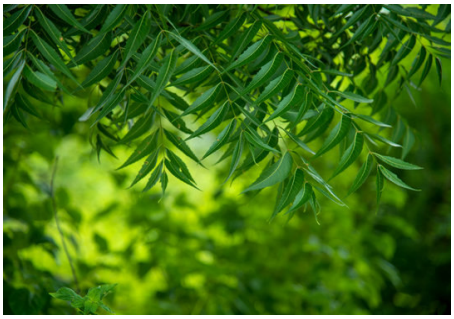

Fig 1: Neem

CURCUMIN

Curcumin is increasingly being acknowledged and used around the world in different forms for its numerous potential health benefits. For example, in India, turmeric, which is rich in curcumin, is a staple ingredient in curries; in Japan, it is enjoyed as tea; in Thailand, it is used in cosmetics; in China, it functions as a dye; in Korea, it is included in drinks; in Malaysia, it acts as an antiseptic; in Pakistan, it is known for its anti-inflammatory effects; and in the United States, it's found in mustard, cheese, butter, and snacks, serving both as a preservative and coloring agent while also being sold in capsule and powder forms. Curcumin can be found in multiple forms, such as capsules, tablets, ointments, energy drinks, soaps, and cosmetic items.(15)

The main mechanisms that account for most of the effects of curcumin on the conditions highlighted in this review are its antioxidant and anti-inflammatory properties. (16) A recent systematic review and meta-analysis of randomized controlled trials regarding the effectiveness of purified curcuminoid supplementation on oxidative stress indicators showed a notable effect of curcuminoid supplementation on all evaluated oxidative stress markers. This included plasma activity levels of superoxide dismutase (SOD) and catalase, as well as serum concentrations of glutathione peroxidase (GSH) and lipid peroxides. (17)

Oxidative stress has been linked to a range of chronic diseases, and its harmful processes are closely related to those of inflammation, with one often provoking the other. In reality, it is recognized that inflammatory cells produce various reactive species at the site of inflammation, leading to oxidative stress, which highlights the relationship between oxidative stress and inflammation..(18) Curcumin has shown the capability to decrease inflammation through multiple mechanisms, which this review does not entirely address, further supporting its potential as an anti-inflammatory agent.(19)

Fig 2: Curcumin

ALOE VERA

Aloe Vera is derived from a tropical succulent plant that belongs to the genus aloe. The term Aloe Vera is derived from the Arabic word "Alloeh," which means "shining bitter substance," referring to the bitter liquid found in its leaves, while "Vera" translates to "true" in Latin. (20)

Aloe Vera (AV) gel has been employed for treating wounds, burns, insect stings, and skin irritations. It has properties that reduce inflammation, fight infection, and prevent harmful microorganisms, along with anti-tumor effects, skin protection, and characteristics that combat diabetes, bacteria, and viruses, all of which play an essential role in wound healing..(21)

Acne is the most common skin condition, affecting individuals in their adolescent and adult years. Aloe vera is remarkably effective in addressing acne and diminishing inflammation on any part of the skin, due to its rich content of various vitamins, minerals, and hormones. Its ability to retain moisture is particularly advantageous for individuals with oily skin..(22) Aloe vera contains six antiseptic substances: lupeol, salicylic acid, urea nitrogen, cinnamic acid, phenols, and sulfur. Each of these compounds has demonstrated the ability to inhibit fungi, bacteria, and viruses.(23Aloe vera is currently included in more than 95% of skin-care products that promote healthy skin. This is attributed to its exceptional capacity to provide moisture.(25)

It boosts the skin's ability to hold moisture and helps remove dead skin cells that encourage the production of collagen and elastin fibers, leading to improved skin elasticity and a decrease in wrinkles, effectively combating age-related skin changes. It smooths the skin by acting cohesively on surface flakes of the epidermis, along with the effects of amino acids.(24)

RAW MATERIAL

HONEY

One of the most commonly used substances throughout human history is honey, which has a long-established reputation for benefiting the skin. Throughout history, honey has often been a key ingredient in early skincare remedies and cosmetic formulations. A Sumerian tablet dating back to around 3000 BC and the Egyptian Ebers Papyrus from approximately 1500 BC both reference the use of honey as a skincare treatment in the past. Early documentation of honey's topical use shows that it has been commonly employed as both a binder and a carrier, in addition to its healing properties. The antimicrobial effects are particularly significant for dermatological applications due to the release of enzymatic hydrogen peroxide and the presence of active compounds like methylglyoxal in Manuka honey. Medical-grade honey is also available. Honey has been utilized to treat conditions such as pityriasis, tinea, seborrhea, dandruff, diaper rash, psoriasis, hemorrhoids, and anal fissures, and it is particularly effective as a dressing for wounds and burns. In cosmetic formulations, honey serves as an emollient, humectant, soother, and conditioner for hair, helps in maintaining youthful skin, delays wrinkle formation, regulates pH levels, and provides protection against pathogen infections. Honey is included in various skincare products, including lip balms, cleansing milks, moisturizing creams, after-sun products, tonics, shampoos, and conditioners. The botanical sources of honey significantly affect its mechanisms of action on skin cells, which involve antioxidant activity, stimulation of cytokines and matrix metalloproteinases, as well as epithelial-mesenchymal transition in damaged epidermis.(25) Honey is listed in the International Nomenclature of Cosmetic Ingredients (INCI) under the labels “Honey” or “Mel” (CAS no. 8028-66-8) and is categorized as an emollient/humectant/moisturizing agent. It is particularly recognized for its benefits in skincare, with regular use believed to maintain youthful skin and slow the formation of wrinkles. Honey is hygroscopic, possesses antibacterial and antifungal properties, nourishes the skin, and assists in regulating the mildly acidic pH of the outer protective skin layer. Due to its humectant nature, it can be incorporated as a natural component in various moisturizing products, while its cleansing features can be utilized in skin soaps, bath and shower formulations, face creams, and lotions. Additionally, honey's anti-irritant and demulcent qualities make it especially suitable for infants and individuals with sensitive skin. Similarly, the moisturizing and anti-irritant features in sun care and sunscreen products help mitigate the effects of the radiation-blocking agents.(25)

A new pharmaceutical formulation intended for topical treatment of mycoses, acne, and various skin disorders has been created, utilizing a blend of antimicrobial essential oils and honey. As outlined in a patent, this combination may be beneficial for hydrotherapy, in addition to serving as an ingredient in moisturizing, anti-aging, and slimming creams, soaps, hair care items, and mouthwash.(26)

The antibacterial effects of honey primarily arise from the hydrogen peroxide that an enzyme introduced by bees creates in the nectar, though some floral sources also provide extra antibacterial substances. An enzyme known as catalase, found in human tissues and serum, breaks down hydrogen peroxide without impacting the antimicrobial compounds present in nectar. It may be advantageous to consider using honey, as it has hydrogen peroxide activity in addition to the elements obtained from nectar, until comparative clinical studies are performed to establish which type of antibacterial action is more potent. Because the enzyme that transforms honey into hydrogen peroxide is destroyed by heat and light exposure, it is advisable to opt for unpasteurized honey and store it in a cool, dark place. If honey must be warmed to become liquefied, the temperature should not exceed 37°C. Should sterilization be required, gamma irradiation is a viable option that does not compromise its antimicrobial capabilities. honey available on the market is frequently subjected to gamma irradiation. This specific type of honey may have a notably high concentration of an antibacterial compound from nectar that remains unaffected by catalase. Staphylococcus aureus displays significant sensitivity to the effects of this antibacterial compound. Similar to other varieties of honey, there can be considerable variations in the potency of honey. Since more than half of the honey sold does not possess a substantial level of this compound, producers employ a "UMF" rating (Unique Factor) that indicates the percentage of phenol with an equivalent effect against Staphylococcus aureus..(27)

CONCLUSION

Natural preservatives in cosmetic products reflects growing consumer awareness and demand for safer, sustainable alternatives to synthetic compounds. Essential oils, plant extracts, and raw materials such as honey offer multifaceted benefits that extend beyond preservation, including antimicrobial, anti-inflammatory, and antioxidant effects. While their use may require higher concentrations or formulation adjustments, these natural alternatives present a viable option for improving product safety and efficacy. Continued research and standardization are essential to optimize their application in modern cosmetics. Embracing these alternatives not only enhances consumer trust but also supports the development of environmentally responsible and health-conscious cosmetic products**.**

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