

A REVIEW ON HERBAL PEEL-OFF (JELLY) MASKS FORMULATED USING SELECTED HERBAL PLANTS

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INTRODUCTION

The growing demand for safe, natural, and environmentally friendly cosmetics has driven a significant shift toward the use of medicinal plants in the personal care and cosmetics industry. Owing to their strong therapeutic activity, minimal side effects, environmental tolerance, biodegradability, and suitability for a wide range of skin types, herbal cosmetics have proven to be an effective substitute for synthetic skincare products. Among these, herbal jelly (peel-off) masks are especially popular because of their gel-like consistency, cooling sensation, ease of application, and ability to deliver bioactive phytoconstituents directly to the surface of the skin.

Herbal jelly masks are topical cosmetic formulations made by combining plant extracts or phytoconstituents with natural or synthetic gelling agents such as carrageenan, pectin, xanthan

gum, agar, sodium alginate, or carbomers to form a gel base. Applied as a thin film over facial skin, the mask allows prolonged contact between the phytoconstituents and the skin surface for greater therapeutic benefit. The gel's high water-holding capacity and elasticity provide excellent hydration, improve skin elasticity, reduce trans-epidermal water loss (TEWL), and enhance the penetration of active phytoconstituents. Regular use helps cleanse the skin, remove excess sebum, minimize enlarged pores, reduce acne, improve texture, maintain moisture balance, and slow early signs of aging.

Medicinal plants are rich in secondary metabolites — including flavonoids, alkaloids, phenolic compounds, terpenoids, saponins, glycosides, tannins, essential oils,

polysaccharides, coenzyme Q10, vitamins, and carotenoids that together provide antioxidant, anti-inflammatory, antibacterial, wound-healing, moisturizing, photoprotective, and anti-aging benefits with comparatively few adverse effects. The selection of appropriate medicinal plants is therefore critical to both the formulation and the therapeutic efficacy of herbal jelly masks: plants with antioxidant activity protect skin cells from UV-induced oxidative stress; those with anti-inflammatory properties reduce erythema and irritation; antimicrobial plants inhibit the organisms responsible for acne; moisturizing plants prevent dryness; and plants rich in vitamins and carotenoids accelerate tissue regeneration and collagen formation.

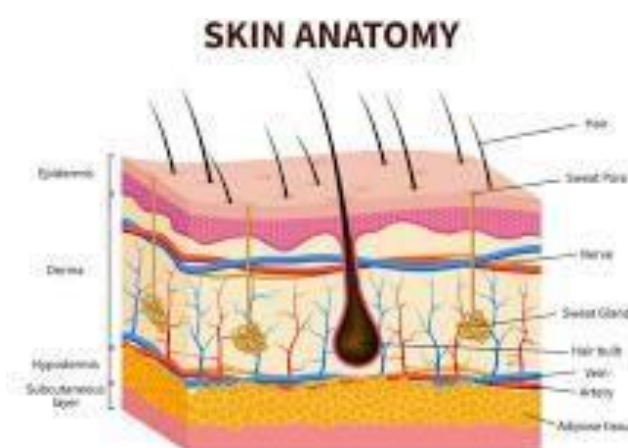
This review focuses on five traditional medicinal plants with well-established dermatological and cosmetic activity: *Trigonella foenum-graecum* L. (Fenugreek), *Myristica fragrans* Houtt. (Nutmeg), *Ocimum tenuiflorum* L. (Tulsi), *Daucus carota* subsp. *sativus* (Carrot), and *Cucumis sativus* (Cucumber). These plants were selected on the basis of their traditional use, pharmacological activity, phytochemical richness, ease of availability, safety profile, and suitability for herbal jelly mask formulation.

- Fenugreek (Fabaceae) — rich in galactomannan, diosgenin, trigonelline, flavonoids, proteins, vitamins, and mucilage, with anti-inflammatory, wound-healing, hydrating, and antioxidant properties; its mucilage content makes it especially suited to gel-based formulations.
- Nutmeg (Myristicaceae) — contains essential oils such as myristicin, sabinene, elemicin, and eugenol, contributing antibacterial, antioxidant, anti-inflammatory, and skin-brightening activity.
- Tulsi (Lamiaceae) — traditionally valued for antimicrobial, antioxidant, anti-inflammatory, and immunomodulatory activity; its eugenol, ursolic acid, rosmarinic acid, and flavonoid content help reduce acne, irritation, and microbial infection.
- Carrot (Apiaceae) — a rich source of carotenoids and vitamins A, C, and E, along with polyphenolic compounds that support tissue repair, collagen production, reduced signs of aging, and improved skin radiance.
- Cucumber (Cucurbitaceae) — valued for its high water content, providing a soothing, antiinflammatory effect that reduces irritation and protects against photoaging.

Together, these five medicinal plants address a broad range of skin concerns — acne vulgaris, excess sebum production, roughness, inflammation, pigmentation, photoaging, loss of elasticity, and uneven tone — offering safe, affordable, and multipurpose benefits for the skin.

Anatomy of Human Skin

With a surface area of roughly 1.5–2.0 m² and accounting for 15–16% of total body weight, the skin is the largest organ in the human body. It forms the primary barrier between the external environment and the internal organs, while also contributing to thermoregulation, immune defence, sensation, vitamin D synthesis, prevention of water loss, and wound repair. Dermatological disorders that impair these functions can have a substantial impact on both the patient and the healthcare system. The skin is composed of three primary histological layers: the epidermis, dermis, and hypodermis.



Epidermis

The epidermis is the superficial layer covering the entire body surface. It is composed of keratinocytes forming an avascular epithelial tissue overlying the vascular dermis, and acts as the first line of defence against pathogens, UV radiation, toxins, allergens, and trauma. It consists of five distinct layers: the stratum corneum, stratum lucidum (found mainly on the palms and soles), stratum granulosum, stratum spinosum, and stratum basale (germinativum). The stratum corneum is made up of non-living, keratinized cells embedded in lipids, forming a barrier impervious to water loss and external damage. The stratum basale contains melanin-producing melanocytes, Merkel cells involved in sensation, and keratinocytes responsible for continual renewal of the epidermis.

Dermis

Positioned beneath the epidermis, the dermis is composed of dense connective tissue containing a network of collagen and elastin fibres, fibroblasts, hair follicles, sebaceous and sweat glands, blood vessels, lymphatics, and nerves. It can be divided into the papillary and

reticular regions, of which the papillary region is most relevant to topical formulations. Collagen provides tensile strength, while elastin provides flexibility and resilience. Fibroblasts synthesize the collagen, elastin, and extracellular matrix components necessary for wound healing.

Hypodermis

The hypodermis, the deepest layer of the skin, is composed predominantly of adipose tissue within a framework of loose connective tissue. It functions as a store of energy, provides insulation, cushions the body against trauma, and supports the layers above it.

Overview of Common Skin Problems

The skin is continuously exposed to environmental pollutants, ultraviolet (UV) radiation, microorganisms, chemicals, and other external insults that can damage the skin barrier and give rise to a variety of skin problems.

- Acne vulgaris — a common inflammatory disorder of the pilosebaceous unit arising from hyperproliferation of keratinocytes, retention of keratin and sebum within follicles, colonisation by *Cutibacterium acnes*, and inflammation. It commonly affects teenagers and young adults, presenting as whiteheads, blackheads, papules, pustules, nodules, and scarring.
- Xerosis (dry skin) — results from disruption of the skin barrier and reduced water content in the stratum corneum, presenting as roughness, scaling, pruritus, tightness, and heightened sensitivity to irritation. Increasing age, low ambient humidity, and use of harsh cleansers are all associated with xerosis.
- Hyperpigmentation — overproduction or uneven distribution of melanin, caused by internal factors (hormonal imbalance, inflammation, scarring, aging) or external factors such as sun exposure, resulting in localised darkening of the skin.
- Premature skin aging — primarily caused by chronic UV exposure, oxidative stress, pollution, smoking, and nutritional deficiencies, resulting in wrinkles, fine lines, reduced collagen levels, loss of elasticity, dryness, and a dull complexion.
- Skin inflammation — conditions such as dermatitis, eczema, and allergic reactions present with erythema, oedema, pruritus, and stinging. Persistent inflammation accelerates skin aging and impairs barrier function.
- Microbial infections of the skin — bacteria, fungi, and viruses can infiltrate a compromised skin barrier; herbal formulations that are effective against these

microorganisms can help manage such infections.

Herbal Peel-Off Mask — A Novel Cosmetic Formulation

Herbal cosmetics are preparations made from natural substances derived from medicinal plants — including plant extracts, essential oils, fixed oils, gums, resins, and mucilage — that support skin health without the adverse effects associated with synthetic chemicals. Often referred to as cosmeceuticals, herbal cosmetics combine the therapeutic properties of medicinal plants with cosmetic benefits. Demand for such products continues to rise as consumers become more aware of the potential harm associated with synthetic fragrances, parabens, sulfates, and other chemical ingredients. Phytoconstituents found in medicinal plants — flavonoids, phenolic acids, alkaloids, tannins, saponins, carotenoids, polysaccharides, vitamins, and essential oils — provide antioxidant, anti-inflammatory, antibacterial, moisturizing, antiaging, and wound-healing benefits.

Herbal jelly masks are among the most recent developments in facial-mask technology. They are prepared by dispersing medicinal plant extracts within a transparent or translucent gel medium. As hydrogel-based, web-like masks, they apply uniformly across the face and form a moist, occlusive layer that preserves hydration and enhances the penetration of active phytoconstituents. Common gelling agents used include carrageenan, agar, pectin, sodium alginate, xanthan gum, and plant mucilage, all of which form firm, elastic gels capable of holding large volumes of water — producing a smooth texture and a long-lasting cooling sensation. The five medicinal plants reviewed here — *Trigonella foenum-graecum*, *Myristica fragrans*, *Ocimum tenuiflorum*, *Daucus carota*, and *Cucumis sativus* — are especially well suited for herbal jelly mask formulation owing to their broad range of pharmacological properties, including antioxidant and antimicrobial activity and demonstrated benefits for skin texture, acne reduction, collagen synthesis, pigmentation, and wrinkling.



Benefits of Herbal Jelly Masks

Herbal jelly masks offer several advantages over conventional masks, combining the superior hydration provided by hydrogel systems with the healing properties of medicinal plants. Key advantages include.

1. Outstanding hydrating and moisturizing effect
2. A cooling sensation that reduces heat-related discomfort and inflammation
3. High water-retention capacity that protects against trans-epidermal water loss
4. Enhanced penetration of phytoconstituents through the outermost layers of the skin
5. An abundance of natural antioxidants that neutralize free radicals
6. Antimicrobial phytochemicals that reduce acne and microbial skin infection
7. Enhanced anti-inflammatory activity that reduces irritation and redness
8. Improved skin suppleness through increased collagen formation
9. A reduction in the visible number of wrinkles
10. Brightening of dull and hyperpigmented skin
11. Mild exfoliation and removal of dead skin cells
12. Suitability for nearly all skin types owing to low irritation potential
13. Fewer side effects, without reliance on potent synthetic chemicals
14. A sustainable, green, and biodegradable formulation
15. High patient acceptance owing to simple application and removal
16. Affordability, making them popular among consumers of natural products

Characteristics of an Ideal Herbal Jelly Mask

An ideal herbal jelly mask should demonstrate appropriate microbiological, physicochemical, and toxicological safety, and should remain stable and effective under a range of storage conditions. Desirable characteristics include.

- A smooth, jelly-like, transparent or translucent appearance.
- A uniform mixture, free from lumps or phase separation.
- A light, naturally attractive colour and aroma.
- A skin-friendly pH, approximately 5.5–7.0.
- Excellent spreadability and ease of application.
- Sufficient viscosity to prevent dripping during application.
- Good water retention, elasticity, and gel strength.
- A non-sticky, non-greasy texture.

- An appropriate drying or setting time for the intended formulation.
- Easy removal that flakes off cleanly, without leaving residue.
- Freedom from irritation, toxicity, or allergic reaction.
- Chemical and physical stability upon storage.
- Sterility, with no bacterial contamination.
- Compatibility with herbal extracts and other formulation ingredients.
- Delivery of phytochemicals to the skin in a bioactive form.
- A comfortable, cooling sensation upon application.
- Improvement in redness, spots, wrinkling, and overall skin appearance.
- Improvement in skin hydration, elasticity, smoothness, brightness, and freshness, without discomfort.

Selected Medicinal Plants

(6.1) Fenugreek — *Trigonella foenum-graecum* L.

Trigonella foenum-graecum L., commonly known as fenugreek (Methi), is a member of the Fabaceae family and one of the oldest medicinal and culinary plants, cultivated across Asia, Europe, North Africa, and the Mediterranean region. For thousands of years, fenugreek has been used extensively in Ayurveda, Unani, Traditional Chinese Medicine, and folk medicine for its exceptional nutritional value.

Fenugreek seeds are valued for their abundance of physiologically active compounds, including steroidal saponins, flavonoids, alkaloids, proteins, dietary fibre, vitamins, minerals, amino acids, and mucilage. These constituents contribute antioxidant, antibacterial, anti-inflammatory, wound-healing, moisturizing, anti-aging, and immunomodulatory activity, making fenugreek a valuable ingredient in herbal cosmetic formulations such as face packs, peel-off masks, creams, gels, serums, lotions, shampoos, and jellies. Because fenugreek seeds are mucilaginous, they naturally moisturize the skin and improve the consistency of topical formulations, while their antioxidant compounds reduce oxidative damage from UV radiation and environmental pollutants. Fenugreek also promotes collagen formation, accelerates healing, improves skin suppleness, and reduces the visibility of wrinkles and fine lines. Its excellent safety profile, natural origin, low cost, and multifunctionality make it one of the most valuable plants used in herbal cosmetic therapy.

Biological Origin: Dried mature seeds of *Trigonella foenum-graecum* L. (Family: Fabaceae/Leguminosae).

Geographical Distribution: Cultivated in India, Pakistan, Bangladesh, China, Egypt, Turkey, Morocco, Ethiopia, France, Spain, Greece, and other Mediterranean countries. India is the largest producer worldwide, with Rajasthan, Gujarat, Madhya Pradesh, Uttar Pradesh, Haryana, and Punjab as the principal growing states.

Macroscopic Morphology: An annual, upright plant growing 30–60 cm tall, with a cylindrical, green, hollow, branching stem. Leaves are trifoliate and obovate with serrated margins. Flowers are solitary, small, and white to pale yellow. Fruits are slender pods 10–15 cm long, each containing 10–20 firm, yellowish-brown seeds.

Physical Properties: Yellowish-brown colour; aromatic odour; bitter taste; rhomboidal, smooth, hard texture; mucilage that readily absorbs moisture (hygroscopic).

Chemical Composition of Fenugreek Seeds (per 100 g)

Constituent	Approximate Value
Protein & amino acids (globulin, albumin, lecithin, histidine, lysine, 4-hydroxyisoleucine)	≈ 25.4 g total
Vitamin A	1040 IU
Vitamin C	12 mg
Niacin	6 mg
Pyridoxine	0.6 mg
Thiamine	0.41 mg
Riboflavin	0.36 mg
Nicotinic acid	1.1 mg
Folate	57 µg

Biological Activities

- Antioxidant action — polyphenols and flavonoids reduce oxidative stress by scavenging free radicals responsible for premature skin aging.
- Anti-inflammatory action — steroidal saponins inhibit inflammatory mediators such as prostaglandin E2 and reduce pro-inflammatory cytokines, decreasing inflammation and redness.
- Antimicrobial action — fenugreek inhibits the growth of several bacteria and fungi linked to skin infections and acne.
- Moisturizing action — mucilage and galactomannan form a hydrating film that helps retain moisture at the skin surface.
- Wound healing — fenugreek accelerates tissue repair by increasing collagen synthesis and fibroblast proliferation.

- Anti-aging action — neutralizes free radicals that degrade collagen and elastin fibres, enhancing skin suppleness.

Skin Conditions Managed: Acne vulgaris, xerosis (dry skin), wrinkles and fine lines, hyperpigmentation, mild skin inflammation, sunburn, rough skin, and loss of elasticity.



Fig. 1: Fenugreek (*Trigonella foenum-graecum* L.).

Mechanism of *Trigonella foenum-graecum* L.

Alkaloids, proteins, carbohydrates, and fiber are among the various chemicals found in fenugreek seed, and these compounds are crucial for inhibiting a wide range of pathologies. As an antioxidant, fenugreek seed scavenges free radicals to stop pathogenesis. The therapeutic action of fenugreek was demonstrated as a pre-treatment of herbal extract, which restored all enzyme activities and demonstrated a complete protective effect against the adjunctive effects of cyclophosphamide and I-buthionine-SR-sulfoximine.

Reduction of glutathione by extract administration may be important for supporting cyclophosphamide-induced apoptosis and free radical-mediated lipid peroxidation in the bladder. Rheumatoid arthritis, cancer, and other illnesses can all be made more likely by persistent inflammation. Controlling it, however, is a better first step toward the disorder's infection. Because of its antiinflammatory properties, fenugreek is essential for managing disorders. The role of fenugreek seed in inflammation was demonstrated. At doses of 100 and 200 mg/kg, the plant extract considerably inhibited edema, and its action at 100 and 200 mg/kg did not differ significantly from that of ibuprofen and dexamethasone. Fenugreek had the greatest suppression of edema among the developed formulations of 3 and 5% creams; hydrocortisone ointment did not show any discernible effects.

Additionally, fenugreek seed plays a significant part in the treatment of diabetes. An animal

model of subdiabetes produced by alloxan was used to study the fenugreek seeds' route of action. The therapy resulted in an aberrant glucose-induced insulin response and a significant decrease in the glucose tolerance curve, indicating that the hypoglycemic action may be mitigated by increasing insulin production from the beta pancreatic cells of Langerhans. Conversely, fenugreek modulates several activities to play a major role in tumor development control. In addition to inducing early apoptotic alterations such as phosphatidylserine translocation and a decrease in mitochondrial transmembrane potential, fenugreek extract reduced cell viability. Additionally, fenugreek seed is essential for managing a number of conditions, such as neurological, cardiovascular, hepatic, and infectious diseases.

Use in Herbal Jelly Masks: Fenugreek is included in herbal jelly masks for its ability to supply natural hydration, reduce blemishes and inflammation, soften rough skin, promote wound healing, and impart a calming, cooling effect.

Processing

Harvesting of mature seeds Drying and cleaning of seeds Grinding into a fine powder Extraction using water or a hydroalcoholic solvent Concentration and filtration of the extract Combination with gelling agents such as carrageenan, agar, sodium alginate, or xanthan gum Addition of preservatives and humectants Filling into sterile containers and storage under appropriate conditions.

Benefits: Natural moisturizer; rich in antioxidants; safe for topical application; economical; readily available; anti-aging; anti-inflammatory; rejuvenating; excellent compatibility with herbal jelly preparations.

Limitations: Strong, pungent characteristic odour; bitter taste requiring careful formulation to mask; potential for allergic reaction in sensitive individuals; and susceptibility to microbial growth in aqueous extracts, requiring proper preservation.

(6.2) Nutmeg — *Myristica fragrans* Houtt

Myristica fragrans Houtt., commonly known as nutmeg, is an evergreen aromatic tree of the family Myristicaceae, growing up to 10–20 m in height. It is native to the Moluccas (Spice Islands) of Indonesia and is widely cultivated across tropical regions including the Indian subcontinent, Sri Lanka, Malaysia, and the Caribbean. Long valued as a spice and flavouring agent, nutmeg is also recognised in traditional medicine for its diverse pharmacological

activities.

The seeds of nutmeg contain essential oils, phenolic compounds, terpenoids, and lignans that exhibit anticancer, antioxidant, antimicrobial, anti-inflammatory, and skin-protective properties. Because of these constituents, nutmeg is commonly used in herbal cosmetic preparations such as face packs, creams, gels, scrubs, and herbal jelly masks.

Taxonomy: Kingdom: Plantae; Family: Myristicaceae; Genus: *Myristica*; Species: *M. fragrans* Houtt.

Biological Origin: Dried seed (kernel) of the mature fruit of *Myristica fragrans* Houtt.

Geographical Distribution: Grown in Indonesia, India, Sri Lanka, Malaysia, Grenada, and other tropical countries; in India, primarily cultivated in Tamil Nadu, Kerala, and Karnataka.

Macroscopic Morphology: A medium-sized evergreen tree, 10–20 m tall, with smooth, dark green, fragrant leaves. The fruit has a bright red aril (mace) and is yellow and juicy, enclosing a firm, elliptical, highly fragrant brown seed.

Physical Properties: Brown colour; strongly fragrant odour; warm, spicy taste; hard, oily texture; oval shape.

Chemical Constituents: Essential oils including safrole, elemicin, myristicin, eugenol, pinene, and sabinene, along with fixed oils, flavonoids, lignans, and phenolic substances.

Pharmacological Activities

- Antioxidant activity — phenolic compounds in nutmeg protect skin cells from free-radical-induced oxidative stress.
- Antimicrobial activity — nutmeg oils inhibit the growth of certain fungi and the bacteria responsible for acne.
- Anti-inflammatory activity — reduces skin irritation, redness, and inflammation.
- Skin-brightening activity — frequent use may help fade pigmentation and improve overall skin tone.

Mechanism of *Myristica fragrans* Houtt

Because it contains phytochemicals such as myristicin, macelignan, eugenol, sabinene, terpenoids, lignans, and phenolic compounds, *Myristica fragrans* Houtt. (nutmeg) has several

beneficial effects on the skin. Strong free radical scavengers, these phytochemicals can function as natural antioxidants to fight ROS-induced skin damage and stop the skin's collagen and elastin from breaking down, delaying the onset of premature aging. By inhibiting the NFB signaling pathway and inflammatory substances such as tumor necrosis factor- α (TNF- α), interleukin-1 β (IL-1 β), interleukin-6 (IL-6), prostaglandins, and nitric oxide in the skin, nutmeg significantly reduces inflammation.

As a result, there is less irritation and inflammation of the skin. It has extensive antibacterial activity, disrupting cell membranes to stop the growth of bacteria and fungus that cause acne. Because of its mildly astringent qualities, nutmeg reduces pore size and influences sebum output, making it less likely to cause acne. As a weak antioxidant, it may have a slight effect on melanogenesis by controlling tyrosinase activity, which would result in a more even-toned appearance. Through enhanced collagen synthesis, cell division, and growth factor release, nutmeg aids in skin restoration, keratinocyte migration, fibroblast proliferation, and cell rejuvenation.

These phytochemicals may also work in concert to remove surface dirt and debris from the skin and facilitate the delivery of active phytochemicals into the skin when combined with a herbal peel-off mask base that contains a film-forming polymer.

Use in Herbal Jelly Masks: Nutmeg is included in herbal jelly masks for its ability to assist in the management of acne and pimples, help remove excess surface oil, enhance skin brightness, provide antioxidant protection, and improve skin texture.

Processing

Mature fruits are harvested. Seeds are separated and dried. Dried seeds are powdered. The powder is extracted using water or a hydroalcoholic solvent. The extract is filtered and incorporated into the jelly mask base.

Advantages: A natural antimicrobial substance; rich in antioxidants; useful in the treatment of acne; enhances the visual texture of the skin; imparts a pleasant aroma.

Limitations: May carry a fragrance that is too strong for some users; risk of skin irritation at excessive concentration in sensitive individuals; requires correct formulation to ensure safety.

SUMMARY

Myristica fragrans is a significant medicinal herb with a high concentration of phenolic compounds and essential oils. Its brightening, anti-inflammatory, antibacterial, and antioxidant properties make it a valuable component of herbal jelly masks intended to reduce acne and improve overall skin appearance.

(6.3) Tulsi — *Ocimum tenuiflorum* L. (Holy Basil)

Ocimum tenuiflorum L. (also known as *Ocimum sanctum* L.), a member of the Lamiaceae family, is known as Holy Basil or Tulsi in India. It is one of the most important Ayurvedic medicinal plants and is traditionally used to treat infections, respiratory conditions, and skin disorders. Its bioactive leaf constituents are widely used in herbal jelly masks, creams, gels, face packs, and cleansers for improving overall skin condition.

Taxonomy: Kingdom: Plantae; Family: Lamiaceae; Genus: *Ocimum*; Species: *O. tenuiflorum* L.

Biological Origin: Fresh or dried leaves and aerial parts of *Ocimum tenuiflorum* L.

Common Names: Holy Basil (English); Tulsi (Hindi and Gujarati).

Geographical Distribution: Native to India and widely cultivated across Bangladesh, Thailand, Nepal, Sri Lanka, and other Southeast Asian countries; thrives in tropical and subtropical climates.

Macroscopic Morphology: An upright, fragrant shrub, 30–90 cm tall, with opposite, strongly fragrant leaves and small white or purple flowers borne on terminal spikes.

Physical Properties: Green to purple colour; strong, slightly pungent fragrance; soft leaf texture.

Chemical Constituents: Ursolic acid, eugenol, rosmarinic acid, orientin, apigenin, linalool, vicenin, tannins, and flavonoids, along with essential oils used in aromatherapy.

Pharmacological Activities: Antimicrobial, antioxidant, anti-inflammatory, and immunomodulatory.

Mechanism of *Ocimum tenuiflorum* L

Because of its many bioactive components, such as eugenol, ursolic acid, rosmarinic acid, apigenin, luteolin, orientin, vicenin, flavonoids, tannins, and essential oils, *Ocimum tenuiflorum* L. (Tulsi) is a well-liked herbal substance with a wide range of dermatological applications. By scavenging reactive oxygen species (ROS), these phytochemicals have potent antioxidant properties that reduce oxidative stress and shield keratinocytes, collagen,

and elastin fibers from premature aging. Tulsi also exhibits strong anti-inflammatory properties by inhibiting the NF- κ B signaling pathway and releasing prostaglandins, nitric oxide, cyclooxygenase-2 (COX-2), interleukin-1 (IL-1), IL-6, and tumor necrosis factor-alpha (TNF).

considerably less irritation, erythema, and inflammation of the skin. Furthermore, Tulsi's phenolic compounds and essential oils have antibacterial activity against fungus and bacteria that cause acne by disrupting the cytoplasmic membrane. Additionally, excess sebum secretion and pore appearance are lessened by the oil's astringent action. Furthermore, by reducing oxidative stress-related anomalies in melanogenesis and regulating tyrosinase activity, rosmarinic acid and flavonoids have brightening effects. Tulsi improves wound healing and skin texture by stimulating fibroblast proliferation, collagen synthesis, angiogenesis, and re-epithelialization.

The synergistic interaction between Tulsi's bioactive compounds and the film-forming polymer in a peel-off mask enhances the bioavailability of the active phytochemicals while optimizing the removal of dissolved sebum, environmental pollutants, and superficial skin debris through deep cleansing. *Ocimum tenuiflorum* is therefore a potent herbal peel-off mask ingredient with a variety of uses to support healthy skin.

Use in Herbal Jelly Masks: Helps prevent breakouts, pimples, and acne; controls excess oil production; reduces skin inflammation; helps prevent bacterial infection; and leaves the skin feeling clean.

Processing: Fresh leaves are cleaned, dried in the shade, ground into a fine powder, and extracted using water or a hydroalcoholic solvent. The filtered extract is then added to the jelly mask base.

Summary: Tulsi is an essential medicinal herb with antioxidant, antibacterial, anti-inflammatory, and antiacne properties, making it an excellent component of cleansing jelly masks that help prevent microbial infection and promote overall skin health.

(6.4) Carrot — *Daucus carota* subsp. *sativus*

The carrot, *Daucus carota* subsp. *sativus*, belongs to the Apiaceae family and is a widely consumed root vegetable rich in antioxidants, vitamins, minerals, and beta-carotene. Carrot extract is used in cosmetic preparations for its antioxidant, anti-aging, hydrating, skin-

rejuvenating, and photoprotective properties, and it helps smooth rough skin while enhancing natural skin brightness.

Taxonomy: Kingdom: Plantae; Family: Apiaceae; Genus: *Daucus*; Species: *D. carota* subsp. *sativus*.

Biological Source: Edible fresh taproot of *Daucus carota* subsp. *sativus*.

Geographical Distribution: Grown worldwide, with North America, Europe, China, and India as leading producers; in India, mainly cultivated in Punjab, Haryana, Uttar Pradesh, Karnataka, and Gujarat.

Macroscopic Morphology: A biennial herb with an enlarged orange taproot, feathery, pinnately divided foliage, and small white flowers arranged in umbels.

Physical Properties: Orange colour; mild odour; sweet taste; firm, meaty texture.

Chemical Constituents: α -/ β -carotene, vitamins A, C, and E, lutein, lycopene, polyphenols, and flavonoids.

Pharmacological Activities: Antioxidant, anti-aging, skin-regenerating, moisturizing, photoprotective, and wound-healing.

Mechanism of *Daucus carota*

Due to its high concentrations of bioactive phytochemicals—carotene, lutein, lycopene polyphenols, flavonoids, vitamin C, vitamin E, and essential minerals—*Daucus carota* L. (carrot) is a commercially significant natural ingredient used in a range of cosmeceutical preparations. These green plant compounds' antioxidant activity aids in the removal of reactive oxygen species (ROS), lowers oxidative stress, and shields keratinocytes, collagen, and elastin fibers from damage caused by free radicals, preventing premature aging and photoaging of the skin. -Carotene, a crucial precursor of vitamin A, promotes keratinocyte differentiation, skin renewal, and regeneration while safeguarding the integrity of healthy skin.

Additionally, carrots provide relief from skin inflammation, erythema, and hyperalgesia by suppressing the NF- κ B signaling pathway and downregulating the production of high levels of pro-inflammatory signaling molecules, such as tumor necrosis factor, interleukin-1 and 6, cyclooxygenase-2, prostaglandins, nitric oxide, and other mediators.

By preventing oxidative damage and collagen degradation brought on by UV light, the flavonoids and carotenoids in carrots further enhance photoprotection. While the carotenoids

encourage tissue regeneration and speed up wound healing, offering skin firmness and resilience, the vitamin C content promotes fibroblast proliferation and collagen synthesis. Carrot also influences melanogenesis, reducing destructive oxidative stress and altering enzymatic activity of tyrosinase, which yields improved skin tone and pigmentation.

When worked into a herbal peel-off mask, the active compounds synergistically remove debris and excess sebum and lift away surface keratinized debris, while supporting enhanced active compounds targeted delivery to the skin, to enhance the antioxidants, anti-inflammatories, photoprotection, skin rejuvenation, collagen protection, wound healing, and skin-lightening effects and yields an efficacious herbal peel-off mask incorporating *Daucus carota* L. Extracts.

Use in Herbal Jelly Masks: Delays visible signs of aging, improves skin tone, hydrates the skin and adds a natural glow, and provides protection against sun damage.

Processing: Fresh carrots are cleaned, peeled, sliced, and crushed. The juice or extract is drained, filtered, and, if needed, concentrated before being mixed with the jelly base.

Benefits: Rich in natural antioxidants; nourishing and protective; increases skin elasticity; enhances skin brightness.

Limitations: Fresh extract has a short shelf life and requires proper preservation for cosmetic use.

Summary: Carrot is one of the best natural sources of carotenoids and vitamins, which help protect the skin from oxidative damage and aging, contributing valuable antioxidant benefits to the formulation.

(6.5) *Cucumber* — *Cucumis sativus* L.

Cucumis sativus L., a member of the Cucurbitaceae family, is one of the most widely used natural ingredients in skin care because of its high water content, cooling effect, and abundance of antioxidants and vitamins. Cucumber extract improves skin texture, reduces swelling, soothes irritated skin, and helps maintain skin hydration.

Taxonomy: Kingdom: Plantae; Family: Cucurbitaceae; Genus: *Cucumis*; Species: *C. sativus* L.

Biological Origin: The juvenile fruit of *Cucumis sativus* L.

Common Names: Cucumber (English); Kheera (Hindi); Kakdi (Gujarati).

Geographical Distribution: Grown worldwide; India, China, Turkey, Iran, and the United States are among the leading producers.

Macroscopic Morphology: An annual, creeping, climbing vine with large, broad green leaves and yellow flowers, producing elongated green fruit containing numerous small, soft seeds.

Physical Properties: Green colour; mild odour; slightly sweet taste; water content of approximately 95%.

Chemical Constituents: Vitamin C, vitamin K, cucurbitacins, flavonoids, tannins, silica, potassium, and magnesium.

Pharmacological Activities: Moisturizing, anti-inflammatory, antioxidant, skin-soothing, cooling, and skintightening.

Mechanism of Action *Cucumis sativus* L.

Due to its many skin advantages, including moisture retention, calming, antioxidant, protecting, and skin-rejuvenating properties, *Cucumis sativus* L., or cucumber, is commonly used as an ingredient in herbal peel-off masks.

Cucurbitacins, flavonoids, phenolic compounds, lignans, ascorbic acid (Vitamin C), tocopherols (Vitamin E), beta-carotene, silica, and various minerals are among the bioactive components of cucumbers that provide these advantages.

By attaching to reactive oxygen species (ROS), these phytochemicals not only have antioxidant activity but also stop keratinocytes, collagen, and elastin from being destroyed, which slows down the aging process of the skin. Tumor necrosis factor-alpha (TNF- α), interleukin-1 beta (IL-1 β), interleukin-6 (IL-6), cyclooxygenase-2 (COX-2), prostaglandins, and nitric oxide are among the inflammatory mediators that are suppressed by cucumber's antiinflammatory action.

Cucumber's high water content, along with the gels, polysaccharides, and silica, guarantees that it has a good emollient function, raising the moisture content of the skin and enhancing its softness and suppleness. Additionally, it is rich in silica, which keeps the skin firm and maintains connective tissues together, and vitamin C, which promotes fibroblast proliferation and collagen formation. Cucumber acts as a mild astringent since it can tighten enlarged pores and reduce excessive sebum discharge. In addition to improving skin tone and reducing dullness, its antioxidant action helps reduce oxidative stress associated with melanogenesis.

However, the abundance of phytochemicals in cucumber can be fully utilized in the application of peel-off masks by cooperating with the film-forming polymer film to induce the removal of pollutants from the environment, excess sebum, and old skin cells while also enabling the direct delivery of active phytochemicals onto the skin.

Use in Herbal Jelly Masks: Hydrates dry skin, minimizes puffiness, eases discomfort from sunburn, helps tighten pores, restores sagging skin, and enhances skin softness.

Processing: Fresh cucumbers are washed and peeled, then crushed and filtered to obtain the juice or extract, which is added to the jelly mask formulation.

Advantages: An excellent natural body moisturizer; cooling and soothing; accessible and inexpensive; suitable for all skin types; a good source of vitamins and minerals.

Limitations: Fresh extract spoils quickly; preservatives are required for extended shelf life.

Summary: Owing to its superior antioxidant, hydrating, and calming qualities, cucumber relieves inflammation, improves suppleness, and promotes a healthy, radiant complexion, making it one of the most valuable natural ingredients for herbal jelly masks.

6. Bioactive Phytochemicals

Medicinal plants used in herbal jelly masks contain a diverse range of bioactive phytochemicals responsible for their therapeutic and cosmetic properties, including antioxidant, anti-inflammatory, antibacterial, moisture-retentive, anti-aging, and wound-healing effects.

Principal Bioactive Phytochemicals

Phytochemical	Plant Source	Biological Activity
Diosgenin	Fenugreek	Anti-inflammatory, anti-aging
Trigonelline	Fenugreek	Antioxidant, skin repair
Galactomannan	Fenugreek	Hydrating, moisturizing
Myristicin	Nutmeg	Antioxidant, antimicrobial
Eugenol	Nutmeg, Tulsi	Antibacterial, anti-inflammatory
Rosmarinic acid	Tulsi	Antioxidant, anti-aging
Ursolic acid	Tulsi	Anti-inflammatory, wound healing
Beta-carotene	Carrot	Antioxidant, skin renewal
Vitamin A	Carrot	Collagen production, anti-aging
Vitamin C	Carrot, Cucumber	Skin brightening, collagen synthesis

Cucurbitacins	Cucumber	Anti-inflammatory
Flavonoids	All selected plants	Antioxidant, UV protection
Polyphenols	All selected plants	Free-radical scavenging
Tannins	Tulsi, Cucumber	Skin-tightening
Essential oils	Nutmeg, Tulsi	Aromatic, antimicrobial

Functions of these bioactive phytochemicals include

- Scavenging free radicals and halting oxidative stress
- Delaying the aging of the skin
- Reducing the proliferation of bacteria and other organisms that cause acne
- Reducing inflammation and redness
- Improving skin moisture retention
- Promoting collagen production
- Supporting wound healing
- Improving skin tone and elasticity

Mechanism of Action

When applied to the skin, the herbal jelly mask forms a gel layer that deposits phytochemicals on the surface and permits prolonged skin contact, allowing sustained release of active constituents.

Antioxidant Mechanism

Flavonoids, polyphenols, beta-carotene, and vitamin C scavenge reactive oxygen species (ROS), preventing lipid peroxidation and the degradation of collagen and elastin fibres. As a result, the skin becomes smoother, with fewer fine lines and wrinkles associated with premature aging.

Anti-inflammatory Mechanism

Bioactive compounds present in the selected plants suppress inflammatory mediators, reducing redness, swelling, and irritation of the skin.

Antimicrobial Mechanism

Essential oils and phenolic compounds interact with microbial cell membranes, inhibiting the growth of bacteria and fungi — including *Cutibacterium acnes* — and thereby reducing the incidence of skin infections and acne.

Mechanism of Moisturization

Galactomannan, mucilage, and polysaccharides form a protective film across the skin barrier, helping to minimize trans-epidermal water loss (TEWL) and improve hydration.

Skin Regeneration

Beta-carotene, vitamin C, and flavonoids stimulate fibroblast proliferation and collagen synthesis, encouraging wound healing and increasing skin suppleness.

Collectively, these mechanisms help moisturize the skin, reduce acne lesions, increase elasticity, reduce visible signs of aging, brighten skin tone, and provide protection from UV-related damage.

Formulation Components of Herbal Jelly Masks

A herbal jelly mask is prepared by combining herbal extracts with suitable excipients to create a stable, smooth, and effective formulation.

Typical Composition

Ingredient	Function
Fenugreek extract	Moisturizer, antioxidant
Nutmeg extract	Anti-acne, antibacterial
Ingredient	Function
Tulsi extract	Antibacterial, anti-inflammatory
Carrot extract	Antioxidant, anti-aging
Cucumber extract	Hydrating, cooling
Carrageenan / Agar	Gelling agent
Xanthan gum	Thickener
Sodium alginate	Gel formation
Glycerin	Humectant
Propylene glycol	Moisturizer and solvent
Distilled water	Vehicle
Methyl paraben / Phenoxyethanol	Preservative
Fragrance	Improves acceptability
Colour (optional)	Enhances product appearance

Preparation Method

Prepare the herbal extracts

Dissolve the gelling agent in warm distilled water Add the remaining excipients and glycerin.

Add the herbal extracts while stirring continuously Adjust the pH to between 5.5 and 6.5.

Add fragrance and preservative Transfer into sterilized containers Store in a cool, dry location.

Evaluation Parameters of Herbal Jelly Mask

Once formulated, the herbal jelly mask is evaluated for quality, stability, safety, and efficacy using the following parameters.

- **Appearance:** The preparation should be smooth, translucent or transparent, and free from phase separation, lumps, and air bubbles.
- **Spreadability:** The ease with which the jelly can be applied to the skin's surface; good spreadability ensures consistent application.
- **Rheological Properties:** Viscosity should be sufficient to prevent dripping during application while remaining easy to spread.
- **Water Retention:** The ability of the gel to retain water over time, contributing to good elasticity and gel strength.
- **Drying/Setting Time:** The mask should set within approximately 15–30 minutes without causing discomfort.

Homogeneity: The formulation should be uniform, with no visible particles or phase separation.

- **Washability:** The mask should be easily removed with water, leaving no residue.
- **Stability Study:** Conducted under various storage conditions to observe changes in colour, odour, pH, viscosity, and microbiological growth over time.
- **Microbial Limit Test:** The formulation should remain within permitted limits for microbial growth and be free from harmful contaminants.
- **Skin Irritation Test:** A patch test is performed on healthy volunteers to assess redness, itching, burning sensation, or allergic reactions.

Future Perspectives

Herbal cosmetics, including herbal jelly masks, represent one of the most rapidly growing segments of the cosmetics industry, as consumers increasingly turn toward natural, eco-friendly, and safer options for skin care. Given their high hydration power, pleasant sensory qualities, and capacity to deliver bioactive phytochemicals, herbal jelly masks hold significant potential as a cosmetic formulation. Future research should focus on.

- Formulation of preservative-free herbal jelly masks (for example, silymarin-based formulations) with enhanced healing potential.
- Application of nanotechnology to more effectively deliver phytochemicals.
- Clinical assessment of safety and effectiveness in human subjects.
- Quality control and standardization of herbal extracts.

- Development of sustainable and biodegradable packaging.
- Commercial-scale production using Good Manufacturing Practices (GMP).
- Evaluation of shelf life and long-term stability.

These developments are expected to enhance the therapeutic potential and commercial viability of herbal jelly masks.

CONCLUSION

Herbal extract-based jelly masks have proven to be an innovative and effective cosmetic formulation that combines the hydrating properties of hydrogel systems with the healing properties of medicinal plants.

The five plants reviewed here — Fenugreek (*Trigonella foenum-graecum*), Nutmeg (*Myristica fragrans*), Tulsi (*Ocimum tenuiflorum*), Carrot (*Daucus carota*), and Cucumber (*Cucumis sativus*) — are rich in bioactive phytochemicals, including flavonoids, polyphenols, vitamins, carotenoids, saponins, essential oils, and polysaccharides, which together provide moisturizing, anti-aging, wound-healing, antibacterial, anti-inflammatory, and antioxidant benefits.

The combined action of these medicinal plants helps reduce acne, regulate skin moisture, delay premature aging, boost collagen synthesis, and protect against oxidative stress and environmental damage. Herbal jelly masks are simple to use, non-greasy, and biocompatible with all skin types, offering a natural and versatile alternative to synthetic skin-care products. Further research into formulation optimization, standardized stability studies, and clinical evaluation will be essential to developing safe, effective, and economically viable herbal jelly mask products. In conclusion, herbal jelly masks formulated from these plants represent an important advancement in herbal cosmetics, with strong potential for future applications in skin care.