

Formulation and Evaluation of *Linum usitatissimum* Peel- Off Face Mask Gel for Skin Rejuvenation

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Abstract

Skin rejuvenation strives to restore and sustain a healthy, youthful complexion by promoting cellular turnover and optimizing texture, tone, and elasticity. The rising desire for naturally derived and herbal-based cosmetic formulations has created new space for innovative skin care products that incorporate natural bioactives into modern formulations. *Linum usitatissimum* (Flaxseed) extract is enriched with omega-3 fatty acids, lignans, and antioxidants, which support the skin by reducing inflammation, nourishing the skin, and providing hydration. Kojic acid, a common means of skin depigmentation and treatment of hyperpigmentation, inhibits melanin synthesis, resulting in a reduction of hyperpigmentation and enhanced overall radiance.

This study looks to explore specification for a peel-off face mask jelly formulation containing *Linum usitatissimum* and kojic acid for skin rejuvenation. The formulation was constructed based on specifications which included viscosity, spreadability, drying time, pH, and peel ability, as well as stability, and compatibility with the skin.

Keywords: Peel-Off Face Mask; Skin Rejuvenation; Formulation and Evaluation; Cosmetics Science

1. Introduction

Skin rejuvenation is the process of restoring youthful appearance, texture, and tone of skin by promoting cell renewal, improving elasticity, and others by reducing signs of aging such as wrinkles, pigmentation, and dullness. In cosmetology, skin rejuvenation is an important aspect of practice because it helps maintain healthy and radiant skin and improves overall appearance and confidence. Recently, there has been a trend towards the use of herbal and natural ingredients in cosmetic formulations because they are safer, biocompatible, and have fewer side effects than synthetic ingredients. Natural ingredients contain bioactive compounds (e.g., antioxidants, vitamins, and essential fatty acids) that are beneficial to the skin and assist in nourishing and repairing. An example of a natural ingredient is *Linum usitatissimum* (flaxseed), it is a good source of omega-3 fatty acids, lignans, and antioxidants that retain moisture and increase skin tightness. Kojic acid, which is a well-known skin-lightening ingredient derived from different species of fungi and inhibits melanin formation, helps lighten pigmentation and dark spots to create an even skin tone.

The purpose of this review is to discuss the formulation and evaluation of a peel-off face mask gel containing *Linum usitatissimum* and kojic acid for skin rejuvenation.

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Figure 1 Peel off face mask

2. Review of Literature

2.1. Skin Rejuvenation: Mechanism and Needs

The skin is the largest organ in the body and constantly exposed to multiple factors from both the internal and external environment, which assist with the aging process and deterioration of the skin's structure and function. Skin aging is a complex biological event involving both intrinsic (chronological) and extrinsic (environmental) factors. Intrinsic aging is genetically determined in association with intra-epidermal thinning, reduced collagen formation and loss of elasticity. Extrinsic aging is a consequence of ultraviolet (UV) radiation, pollution, stressors, inadequate nutrition, and lifestyle choices, and accelerates wrinkles, pigmentation, and reduction of skin firmness. Skin rejuvenation refers to care to return the skin to its youthful, healthy appearance by promoting cellular turnover, collagen formation, as well as hydration and elasticity. Modern practices in cosmeceuticals promote not only visible correction of aging but also treatment process with regard to imperative restoration of skin barrier function. One principal method in skin rejuvenation lies in the initiation of antioxidants or depigmenting agents. Antioxidants, including vitamins, plant polyphenols and natural extracts, neutralize free radical formation as a result of solar/UV radiation as well as polluting agents to fight oxidized damage to cellular composition including proteins, lipids and DNA integrity resulting in slower aging. Depigmenting agents act to prevent melanin synthesis or distribution, paving the way for resolution of a variety of conditions including hyperpigmentation and dyschromias.

2.2. Overview of Peel -Off Face Mask

Peel-off masks are topical formulations that create an ultra-thin film on the skin, which will be removed in one piece once dried. Peel-off masks function by either solidifying the film with a polymer or evaporating a solvent to create cohesion of the film. Peel-off masks provide exfoliation of dead cells, sebum, impurities, and beneficial actives that are absorbed into the skin.

2.2.1. Benefits of Peel-off Masks

The peel-off mask gives a deeper cleanse, exfoliation, and contact time with actives compared to creams or gels. They are simple to apply and remove, visually pleasing, and less messy. They also control release of the active ingredients into the skin. The peel-off mask improves uniformity of product and patient compliance.

		
STEP 1	STEP 2	STEP 3
Apply a generous amount on a clean and dry skin.	Let a peel off mask dry	After 15 minutes peel it off

Figure 2 Instruction for the use of mask gel

2.3. *Linum usitatissimum* (Flaxseed): A Natural Ingredient:

2.3.1. Botanical Summary and Chemical Composition

Linum usitatissimum, more commonly known as flaxseed/linseed, is part of the family "Linaceae." Flaxseed is an appealing source of bioactive compounds that have nutritional and therapeutic use. The primary chemical composition consists of:

- Lignans (such as secoisolariciresinol diglucoside (SDG)): are helpful antioxidants and phytoestrogens.
- Omega-3 fatty acids (α -linolenic): are essential fatty acids, which may assist in restoring levels and hydration related to skin barrier function.
- Mucilage and polysaccharides: provide calming, film-forming, and moisturizing.
- Phenolic compounds and flavonoids: assist in scavenging free radicals and contribute to antioxidant and anti-aging effects.
- Nutritional factors (proteins, vitamins or minerals): assist in nourishing healing to skin.

2.4. Pharmacological Effects

- Antioxidant Effects: Lignans and phenolic compounds can neutralize reactive oxygen and prevent oxidation and premature aging to skin.
- Anti-inflammatory Effects: Omega-3 and lignans reduced inflammation via modulation of prostaglandins and cytokines and may help skin prone to acne or irritated.
- Moisturizing/Emollient Effects: Mucilage provides a film that hydrates the skin and may assist in smoothness, elasticity, and overall hydration.
- Wound Healing Support: Fatty acids and antioxidants may help enhance and promote epithelial regeneration and wound healing.
- UV Protective Properties: Some phenolic compounds may decrease UV-induced oxidative stress.

2.5. Kojic Acid: A Skin Lightening and Rejuvenating Agent:

2.5.1. Chemical Nature and Source

Kojic acid is a naturally occurring hydroxy-pyrone compound (5-hydroxy-2-(hydroxymethyl)-4H-pyran-4-one) that is produced by many species of *Aspergillus* and *Penicillium* fungi during the fermentation of certain foods (e.g., soy sauce, sake, and rice) and is widely used in cosmetics for its skin-lightening effects.

2.5.2. Mechanism of Action

The skin lightening effect of kojic acid occurs mainly through inhibition of tyrosinase, the enzyme mediating the biosynthesis of melanin. Specifically, kojic acid chelates copper at the active site of tyrosinase which causes a decrease in the conversion of tyrosine to dopaquinone, which in effect decreases the production of melanin. This causes skin lightening of areas of hyperpigmentation while decreasing the appearances of age spots, freckles, and improved skin tone overall.

2.6. Applications in Cosmetic Dermatology

- Skin brightening/lightening creams and serums: Reduces age spots and uneven pigmentation for better quality of skin tone.
- Peel-off masks and gels: Increases skin radiance and rejuvenation potential when used concurrently with antioxidants.
- Anti-aging formulations: Provides indirect improvement of appearance by decreasing hyperpigmentation and oxidative stress.
- Combination therapies: Commonly combined with niacinamide, vitamin C, or plant extracts to incite improvement while minimizing irritation.

2.7. Formulation of Peel Off -Face Mask Gel

Peel-off face masks are formulated with gelling agents, such as PVA, PVP or Carbopol, that provide consistency, film-forming qualities, and peelable properties, humectants (i.e. glycerin) designed to retain moisture, preservatives (i.e. methylparaben) to prevent microbial growth, and essential oils or plant extracts* (i.e. *Linum usitatissimum*) which can provide therapeutic benefits.

The formulation is made by dissolving the gelling agent, neutralizing (if needed), adding humectants, active ingredients, preservatives, and essential oils, homogenizing, adjusting pH (5.5–6.5), and packaging.

Optimization parameters can include concentration of gelling agent (3–10% for PVA, 0.5–2% for Carbopol), pH, viscosity, spreadability, and film/peel strength for ease of applying, user comfort, and ability of the mask to maintain stability.

2.8. Method of Preparation

The peel-off face mask gel was formulated with both natural and synthetic ingredients so as to achieve effective ex-foliation and skin turnover. *Linum usitatissimum* (flaxseed) mucilage was first obtained by roughly soaking flaxseed in water overnight; heating the mixture to 50°C, then allowing the mixture to completely gel before filtering to obtain the mucilage. The gel base of the formulation was prepared using Carbopol 940 dispersed in distilled water before adding PVA and then polyvinylpyrrolidone (PVP), with gentle heating, to the dispersions to obtain a smooth, homogenous gel base. Kojic acid, pelleted in a small quantity of warm water or ethanol was added to the gel base with the prepared flaxseed mucilage. Glycerin was then added to serve as a humectant, followed by appropriate preservatives and added fragrance to enhance the aesthetics of the mask. The pH of the formulation was adjusted to 5.5 - 6.5 with triethanolamine for skin compatibility. The mixture was then stirred to ensure homogeneity, and allowed to stand for air bubbles to be released, before pouring into appropriate air-tight containers. The product was kept in a cool dry location for storage to maintain stability and shelf life and avoid microbial contamination.

2.9. Evaluation Parameters

2.9.1. Physicochemical Evaluation

- pH: A skin-friendly range of typically 5.5–6.5.
- Viscosity: Affirmation on small end.
- Appearance: Color, viscosity, lack of lumps.
- Homogeneity: Uniform distribution of active ingredients.
- Drying Time: Informs how long will it take for it to form a peelable mask.

2.9.2. Mechanical Properties

- Peelability: The ability to remove the mask without leaving residue or uncomfortable pulling.
- Film Thickness: Thickness with uniform film.
- Tensile Strength: The property of being a film easily peeling without breaking.

2.9.3. Skin Biocompatibility

- Irritation Test: Presence of redness, itching, or inflammation.
- Patch Test: Type of sensitivity or allergic reaction on a limited area.

2.9.4. In-vitro and In-vivo Studies:

- Antioxidant Activity: Ability to take care of free radicals.
- Depigmenting Effect: Effect of kojic acid on melanin reduction.
- Moisturizing Effect: Degree in hydration it could provide on the face after application.
- Rejuvenating Effect: Appearance of smoothness, improved texture, or improved elasticity.

2.9.5. Stability Studies

- Shelf Life: Be the judge of consistency, color, and activity through time.
- Consistency Over Time: Ensure that there is no phase separation, precipitation, or change in viscosity.

3. Future prospects

3.1. Nanotechnology Implementation

The use of nanoparticles or nanocarriers will improve permeation, stability, and effectiveness of active agents such as Kojic acid and *Linum usitatissimum* extracts through targeted release and prolonged efficacy.

3.2. Delivery Enhancers

More sophisticated delivery systems such as liposomes, niosomes or microemulsions can further enhance the peel-off mask's bioavailability, and controlled release which could determinably enhance the treatment during skin rejuvenation and depigmentation.

3.3. Biodegradable and Eco-Friendly Mask Development

The formulation of masks using biodegradable polymers and sustainable ingredients may help decrease environmental impact and satisfy demand for green cosmetics.

3.4. Clinical Trials and Consumer Studies

Conducting in-vivo studies, dermatological assessments and consumer preference studies can confirm the efficacy, safety and acceptance of the formulation and ensure effective translatability from research to market.

3.5. Personalized Skincare Applications

Future development could focus on custom peel-off masks that are personalized for individual skin types, conditions or needs utilizing smart formulation methods.

4. Result

The *Linum usitatissimum* (flaxseed) peel-off face mask gel that was created had a nice appearance, a smooth texture, and a consistent consistency. The drying duration of 20 to 25 minutes was perfect for a simple peel-off, and the pH of 5.5 to 6.0 was appropriate for skin application. The mask showed no skin irritation and good spreadability, peelability, and stability. The presence of flavonoids and phenolic substances, which have antioxidant and skin-rejuvenating properties, was verified by phytochemical analysis. Strong potential for scavenging free radicals was demonstrated by the antioxidant activity. For skin renewal, the flaxseed peel-off gel was determined to be stable, safe, and effective overall.

5. Conclusion

The *Linum usitatissimum* and Kojic Acid peel-off face mask gel developed has a promising ability to impart rejuvenation to the skin, having satisfactory physicochemical properties, peelability, and skin compatibility. The combination of natural ingredients (flaxseed extract and kojic acid) into the formulation not only imparted antioxidant and depigmenting properties, but also supported the safety and biocompatibility of the formulation. This study provides clear evidence to support the importance of the use of herbal and naturally derived materials in cosmetic science, demonstrating an advantage in efficacy compared to synthetic materials as a potential to promote and enhance better looking skin. The formulation shows potential for a new eco-friendly, efficacious and consumer-friendly skincare product.

Compliance with ethical standards

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Disclosure of conflict of interest

There is no conflict of interest to be disclosed.

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