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Formulation and Evaluation of a Peel-Off Mask from Custard Apple

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Abstract

Herbal cosmetics have a long history of use aimed at enhancing cosmetic appearance and mitigating skin conditions such as acne, pigmentation, dryness, and wrinkles. These products provide various health benefits, including anti-acne, anti-inflammatory, moisturizing, antioxidant, and anti-aging effects, while also minimizing the risk of adverse reactions. Herbal formulations have gained global popularity and acceptance due to their natural origin, safety, and effectiveness in maintaining skin health. Traditional Indian herbs, like custard apple peel, liquorice root, and neem, have been essential components of skincare routines for many centuries because of their therapeutic and protective properties. These herbal ingredients are widely recognized for their antimicrobial, soothing, and rejuvenating effects on the skin. In this study, various herbal ingredients were utilized in the formulation of a herbal peel-off face mask. Extracts from custard apple peel, neem leaves, and liquorice root were incorporated into the formulation because of their well-known dermatological benefits. Custard apple peel possesses natural antioxidants and cleansing properties that help in removing impurities and dead skin cells. Neem is well-known for its antibacterial and antifungal activity, which helps in preventing acne and skin infections. Liquorice root is widely used for its skin-brightening, anti-inflammatory, and soothing properties. The peel-off mask was prepared using suitable film-forming agents and natural extracts to develop a smooth, uniform formulation. The prepared formulation was evaluated for various physicochemical and cosmetic parameters such as appearance, pH, spreadability, drying time, consistency, and stability. The results indicated that the formulated herbal peel-off mask possesses a neutral pH and is gentle and safe for topical application. The stability study showed that the formulation remained stable under different storage conditions without any significant changes in its physical characteristics. Overall, the developed herbal peel-off mask demonstrated effective cleansing ability, reduced pore size, and improved skin texture. It forms a flexible, residue-free film upon drying, which can be easily peeled off, leaving the skin refreshed, smooth, and revitalized. Therefore, this herbal formulation may serve as a safe, effective, and natural alternative to synthetic cosmetic products for routine skincare.

Keywords: Custard apple peel, neem, liquorice root, traditional Indian herbs, peel-off mask

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INTRODUCTION

Currently, various peel-off masks are available on the market to address skin issues like blackheads, dead skin, whiteheads, and acne. These masks not only eliminate impurities but also nourish the skin. Byproducts from natural sources can play a significant role in cosmetic formulations. This herbal blend consists of several natural ingredient powders that help nourish the skin, promote a radiant appearance, soothe irritation, and eliminate impurities [1].

Peel-off masks were specifically created for use in beauty salons during medical treatments. The

mask is ready for use, allowing it to be directly applied to the skin. As the elastic mask film is applied, moisture gathers in the outer layer and gradually solidifies, preventing water or air from passing through. Concurrently, the primary active ingredients in the formula, along with any additional active substances, effectively penetrate the skin and quickly deliver the concentrated compounds [2, 3].

Herbal cosmetics are beauty products that derive their beneficial physiological properties, such as brightening, anti-inflammatory, hydration, nourishment, and anti-aging benefits, from botanical ingredients. These herbal cosmetics are designed to protect and improve the skin. Once it has completely dried, the flexible film can be peeled away from the face, leaving a thin, plastic-like layer without any residue [4].

The custard apple, scientifically referred to as *Annona squamosa* L. (Figure 1), is a tropical fruit belonging to the Annonaceae family. Originating from the Caribbean, Central America, and northern South America, this fruit has become widely recognized globally, not just for its sweet, creamy flesh but also for its various health benefits and medicinal uses. The custard apple is known by different names in various regions, including sugar apple, sweetsop, and sitaphal in India [5].

Figure 1. *Annona squamosa* (custard apples).

Antioxidant Benefits

Custard apples are packed with antioxidants that defend the body against oxidative stress and lower the likelihood of developing chronic diseases like cancer and heart disease. Its high levels of vitamin C and polyphenolic compounds boost the fruit's capacity to counteract free radicals and prevent cellular damage [6].

Anti-Inflammatory Properties

Prolonged inflammation significantly contributes to a range of health issues such as arthritis, heart disease, and diabetes. The anti-inflammatory properties of custard apples, linked to its abundant flavonoids and other bioactive compounds, can help diminish inflammation and ease symptoms related to these conditions [7–8].

Scientific Classification

- *Kingdom:* Plantae.
- *Clade:* Tracheophytes.
- *Division:* Angiosperms.
- *Subclass:* Magnoliidae.
- *Order:* Magnoliales.
- *Family:* Annonaceae.
- *Genus:* Annona.
- *Species:* A. squamosa.

PEEL-OFF MASK INFORMATION

The primary aim of the peel-off formulation is to shield the skin from environmental factors while helping to lessen acne and various surface flaws. It is also crucial for managing oily skin by enhancing the complexion, making it more radiant and devoid of excess oil. Compared to developing a gel-based product on its own, the peel-off formulation offers a more straightforward, safer, and more efficient treatment option [9].

It is essential to care for the skin, as it serves as a fragile and protective barrier for the body and is subject to environmental pollutants. To address issues related to skin health, facial skin requires proper care, and one effective method is the use of face masks. A peel-off mask is applied to the face as a thin layer of liquid film spread evenly with the fingers. This type of mask can deeply cleanse pores, remove dirt, and tighten, rejuvenate, and heal the facial skin. Additionally, peel-off masks may provide slight moisturization while enhancing the occlusive effect, which boosts blood circulation, stimulates skin cells, and aids in the removal of impurities [10].

Types of Peel-Off Face Masks

Modern face masks are classified into four main types:

- *Peel-Off:* A single continuous sheet is applied to the skin, allowed to dry for approximately 30 minutes, and then removed. These masks are ideal for providing both purifying and rejuvenating effects. When the polymeric layer is removed, it effectively eliminates the outermost layer of dead skin cells to unveil healthier-looking skin.
- *Sheet:* Sheet masks are highly adaptable as they are infused with potent serum formulations containing active ingredients to fulfill the intended purpose of the product such as brightening, anti-aging, and oil control.
- *Leave-On:* These masks are available in crème-gel or cream formulations that are highly hydrating. They are applied to the skin and left on for 15 to 30 minutes, or even overnight, after which any excess product is massaged into the skin. These masks are designed to offer more hydration and emollience compared to standard creams, as they contain higher levels of lipids and humectants.
- *Charcoal/Clay:* By incorporating charcoal or clay, these masks function as essential cream cleansers. This addition also enhances viscosity. Clay and charcoal provide excellent nourishment for microorganisms, so it is important to purchase them in a properly prepared state. Therefore, proper preservation of this type of product is essential [11].

AIM AND OBJECTIVE

The aim of using peel-off face masks is to quickly restore the skin's natural radiance and luminosity, as well as to provide a soothing and calming effect. They help diminish blackheads and acne while simultaneously nourishing the skin. Their natural ingredients contribute to the reduction of blackheads and acne.

The objective of this work was to formulate a peel-off mask that effectively eliminates debris, bacteria, dirt, and other impurities to achieve balanced, toned, and healthier skin. This mask aims to exfoliate the top layer of skin along with dead and dull skin cells, resulting in a smooth, radiant, and refreshed complexion. As it dries and tightens, the mask assists in extracting debris, bacteria, blackheads, and whiteheads from the skin's surface. The process involved the identification and collection of herbal plants. The use of herbal ingredients can reduce the reliance on synthetic preservatives [12].

HERBAL CONSTITUENTS

Custard Apple

- *Scientific Name: Annona squamosa*.
- *Synonyms: Annona asiatica* L. [13], Annona cinerea *Dunal, Xylopia glabra* L. [14], sugar apple.
- *Chemical Constituents: Annona squamosa* is composed of various components including alkaloids, phenolic compounds, flavonoids, saponins, tannins, phytosterols, carbohydrates, proteins, and amino acids [15].

Neem Leaves

- *Scientific Name: Azadirachta indica* (Figure 2).
- *Synonyms: Neem,* Antelaea azadirachta *(L.) Adelb,* Antelaea canescens *Cels ex* Heynh, Antelaea javanica Gaertn [16].
- *Chemical Constituents:* The leaves contain quercetin, catechins, carotenes, and vitamin C [17].

Figure 2. *Azadirachta indica*.

Neem extract provides numerous advantages when used in peel-off mask formulations. Renowned for its antibacterial and antifungal properties, neem extract effectively targets acne-causing bacteria and reduces inflammation, making it an excellent choice for those with blemish-prone skin. Furthermore, neem extract helps regulate oil production, making it ideal for oily and combination skin types. In summary, neem extract enhances the efficacy of the peel-off mask by fostering clearer, healthier skin [18].

Liquorice Root

- *Scientific Name: Glycyrrhiza glabra* (Figure 3) [19].
- *Synonyms: Mulethi,* Glycyrrhiza brachycarpa *(Boiss.),* Glycyrrhiza glandulifera *Waldst. & Kit.,* Glycyrrhiza hirsuta (Pall.) [20–22].
- *Chemical Constituents:* Liquorice root contains a variety of compounds, including triterpenoids, polyphenols, and polysaccharides such as starches, mannose, and sucrose [23].

Figure 3. *Glycyrrhiza glabra*.

The primary bioactive constituents in liquorice root are flavonoids and triterpene saponins, such as liquiritin, liquiritigenin, isoliquiritigenin (ISL), and glycyrrhizin, also known as glycyrrhizic acid [24, 25]. ISL, a flavonoid present in liquorice, has demonstrated a range of pharmaceutical effects, including anti-platelet, anti-allergic, anti-tumor, anti-inflammatory, and antioxidant properties [26, 27].

CHEMICAL CONSTITUENTS USED IN THE FORMULATION

Polyvinyl Alcohol (PVA) (Figure 4)

- *IUPAC Name:* Poly(1-hydroxyethylene).
- *Molecular Formula:* $[CH_2CH(OH)]$ n.
- *Molecular Weight:* 44.05 g/mol.

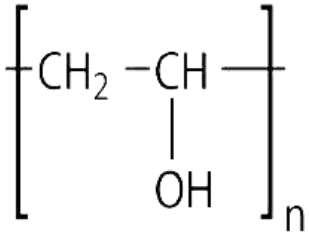

Figure 4. Molecular structure of PVA.

Hydroxypropyl Methylcellulose (HPMC) (Figure 5)
- *IUPAC Name:* Cellulose, 2-hydroxypropyl methyl ether.
- *Molecular Formula:* $C_{56}H_{108}O_{30}$.
- *Molecular Weight:* 1,261.45 g/mol.

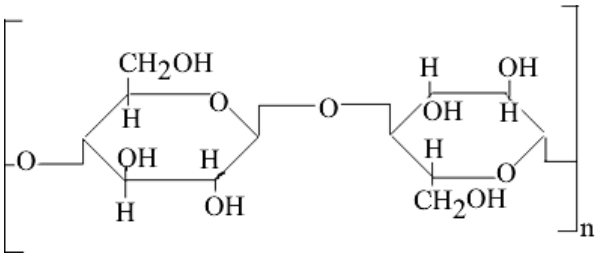

Figure 5. Molecular structure of HPMC.

Glycerin (Figure 6)
- *IUPAC Name:* Propane-1,2,3-triol.
- *Molecular Formula:* $C_3H_8O_3$.
- *Molecular Weight:* 92.09 g/mol.

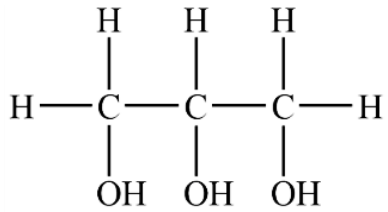

Figure 6. Molecular structure of glycerin.

Ascorbic Acid (Figure 7)
- *IUPAC Name:* (5R)-[(1S)-1,2-Dihydroxyethyl]-3,4-dihydroxyfuran-2(5H)-one.
- *Molecular Formula:* $C_6H_8O_6$.
- *Molecular Weight:* 176.12 g/mol.

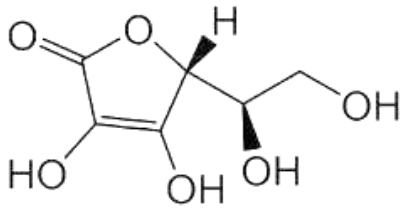

Figure 7. Molecular structure of ascorbic acid.

Propyl Paraben (Figure 8)
- *IUPAC Name:* Propyl 4-hydroxybenzoate.
- *Molecular Formula:* $C_{10}H_{12}O_3$.
- *Molecular Weight:* 180.2 g/mol.

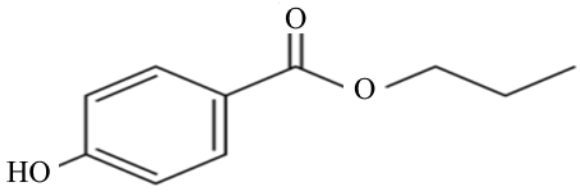

Figure 8. Molecular structure of propyl paraben.

Lactic Acid (Figure 9)
- *IUPAC Name:* 2-Hydroxypropanoic acid.
- *Molecular Formula:* $C_3H_6O_3$.
- *Molecular Weight:* 90.08 g/mol.

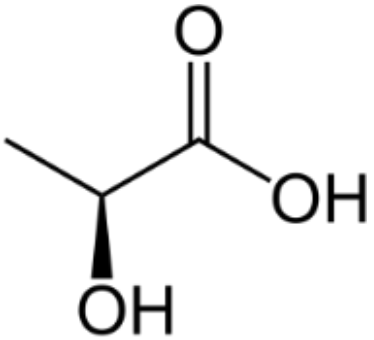

Figure 9. Molecular structure of lactic acid.

Water (Figure 10)
- *IUPAC Name:* Oxidane.
- *Molecular Formula:* H_2O.
- *Molecular Weight:* 18.01528 g/mol.

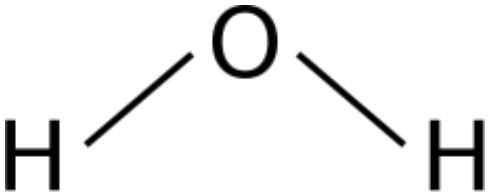

Figure 10. Molecular structure of water.

Lavender Oil

Lavender oil, obtained from a local market, was added to the mixture at a dosage of 4–5 drops. It is recognized for its antibacterial and calming characteristics and is also appreciated for its pleasant scent. Lavender oil contributes a relaxing aroma to the peel-off mask, improving the overall sensory experience during its application. The inherent antimicrobial qualities of lavender oil aid in preventing bacterial growth on the skin, which can lead to a fresher and clearer complexion and lower the likelihood of acne and other skin irritations [28].

EXTRACTION METHODS OF HERBAL INGREDIENTS

Extraction of Custard Apple Peel [29]
- The peels were rinsed, dried, and then crushed into fine fragments.
- The fragments were immersed in distilled water or a 50% ethanol-water blend for 12 to 24 hours.
- Optionally, the mixture was gently heated to 40–50°C to enhance extraction.
- The mixture was then strained to eliminate solids.
- The resulting liquid was either concentrated under lower pressure or used directly in the mask.

Extraction of Neem Leaves
- Neem leaves were rinsed and allowed to air-dry.
- The leaves were ground into a paste or powder and then immersed in distilled water or a 30–50% ethanol solution for enhanced preservation.
- The mixture was left at room temperature for 12 to 24 hours or heated gently at 40°C.
- Finally, it was strained to obtain a clear extract.

Extraction of Liquorice Root

- The liquorice roots were cleaned and chopped into small segments.
- The segments were simmered in distilled water for 15–20 minutes to create a decoction.
- Alternatively, a hydroalcoholic extraction was performed using a 50% ethanol-water solution at a temperature of 40–50°C.
- The mixture was allowed to cool and then strained [30–32].

METHOD OF PREPARATION

Phase 1: Preparation of Film-Forming Base

- Distilled water was heated to a temperature of 75°C.
- While maintaining a steady temperature, Polyvinyl Alcohol (PVA) was gradually incorporated into the hot water.
- The mixture was continuously stirred at a high speed to prevent clumping.
- Once the PVA was fully dissolved, Hydroxypropyl Methylcellulose (HPMC) was added to the same container.
- Stirring was continued until the HPMC had completely dissolved and the base was smooth and free of lumps.

Phase 2: Preparation of Active Ingredients

- In a separate container, glycerine, liquorice root extract, custard apple peel extract, neem leaf extract, and Ascorbic Acid were combined at room temperature.
- The blend was stirred gently to ensure that all powders and extracts were fully dissolved in the glycerine phase.

Phase 3: Final Blending

- After the film-forming base had cooled to approximately 40°C, the active phase (Phase 2) was gradually incorporated into it with constant mixing.

Phase 4: Addition of Preservative

- Once combined, propyl paraben was included as the preservative.
- The specified quantity of lavender oil was added for fragrance [33].

Formulation of the peel-off mask has been given in Table 1.

Table 1. Formulation of the peel-off mask.

S.N.	Ingredients	Function	Quantity
1.	Custard apple [*Annona squamosa*] Peel extract	Anti-oxidant Anti-inflammatory	1.00 gm
2.	Neem leaves [*Azadirachta indica*] extract	Anti-bacterial Anti-fungal	0.40 gm
3.	Liquorice root [*Glycyrrhiza glabra*] extract	Smoothing Brightening Anti-irritant	1.00 gm
4.	Polyvinyl alcohol [PVA]	Film forming agent Water soluble	4.00 gm
5.	Hydroxypropyl Methylcellulose (HPMC)	Thickener Stabilizer Emulsifier	0.40 gm
6.	Glycerine	Solvent Humectant	2.54 ml
7.	Ascorbic acid	Anti-oxidant Skin brightening agent	1.00 gm
8.	Propyl paraben	Preservative Effective against yeast	0.1 ml
9.	Lactic acid	pH adjuster	q.s
10.	Lavender oil [fragrance]	Aesthetic enhancement	0.04 ml
11.	Water	Solvent	8.94 ml

EVALUATION PARAMETERS

pH Measurement

The pH of the formulation was measured using an electronic pH meter. Prior to measurement, the pH meter was calibrated with standard buffer solutions at pH levels of 4, 7, and 9 [34].

Physical Assessment

The physical attributes, such as color, appearance, consistency, and texture, were evaluated for the prepared formulation [35].

- *Color:* The color of the formulation was assessed against a white background.
- *Consistency:* The formulation's consistency was evaluated by applying it to the skin.
- *Greasiness:* The greasiness of the formulation was assessed by applying it to the skin.
- *Odor:* The gel's odor was analyzed by mixing the gel with water and observing the scent.

Peel-Off Test

After application, the peel-off gel was evenly distributed across the face and hands and left to dry. The optimal drying time for a peel-off gel mask typically ranges from 15 to 30 minutes. The drying time for the gel mask was determined to be 18 minutes using a stopwatch. Following complete drying, the mask was easily removed from the skin without breaking.

Washability

The formulations were applied to the skin, and the ease of washing with water was thoroughly evaluated. The washability of the prepared peel-off mask was found to be satisfactory.

Irritation Test

This aspect was assessed through a patch test. Any indications of skin irritation at the patch site could imply an allergic reaction.

Spreadability

To evaluate spreadability, an excess sample of the gel was placed between two glass slides and pressed to achieve a uniform thickness by applying a specified weight. The time taken for the upper glass slide to separate from the lower slide was measured as an indicator of spreadability [36].

$$S = m \times l / t$$

where:

- S = Spreadability.
- m = Weight tied to the upper slide.
- l = Length moved on the glass slide.
- t = Time taken.

PACKAGING

The mask was transferred into airless pump bottles to safeguard it against contamination.

CONCLUSION

There is a growing demand for remedies for various skin issues that do not produce side effects. A potential exists to create safer cosmetics by utilizing herbal plant ingredients and their derivatives as alternatives to synthetic compounds. This research indicates that the formulation has excellent spreadability and maintains stability at room temperature, which enhances user comfort during application. The peel-off mask is suitable for all skin types, showing good compatibility without causing irritation or allergic reactions. When applied to human skin, the peel-off mask displayed effective peeling properties without causing itchiness or irritation and left no residue. The investigation of this herbal peel-off mask confirmed its potential to remove dead skin cells, reduce pigmentation, enhance skin radiance, clear clogged pores, and restore moisture. The product has a texture that is appropriate for all skin types and offers good distribution. The formulated product effectively cleanses the skin's surface and may help protect it from external elements.

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