

"Formulation and Evaluation of Face Sheet Masks: A Comprehensive Analysis of Ingredients, Their Benefits, Brands"

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Abstract:

Face sheet masks are gaining significant popularity in the skincare industry due to their convenience and effectiveness. This study provides an in-depth analysis of various active ingredients used in the formulation of face sheet masks, categorizing them into botanical, fruit, and marine-based ingredients. Key plant-based ingredients such as Calendula, Camellia, Hibiscus, Lavender, and others are known for their soothing, anti-inflammatory, and hydrating properties, while fruit-based components like papaya, lemon, and pomegranate are celebrated for their exfoliating and brightening effects. Additionally, marine extracts such as seaweed and pearl are renowned for their moisture retention and anti-aging benefits. The study also reviews the types of face sheet masks, their composition. The evaluation parameters used for assessing these masks including efficacy, ingredient compatibility, and sensory attributes.

Keywords:

Face sheet masks, botanical ingredients, fruit extracts, marine-based ingredients, skincare, anti-aging, hydration, ingredient efficacy, cosmetics formulation, ingredient stability, consumer safety.

INTRODUCTION

The skin is the largest organ in the human body, constituting approximately 16% of total body weight. Therefore, it is essential to highlight its various functions. The skin plays a crucial role in maintaining homeostasis by regulating body temperature and fluid content, while also serving as the primary barrier against the external environment. It protects the body from pathogenic agents, toxins, and ultraviolet radiation. The appearance and texture of the skin are significantly affected by the hydration levels of both the epidermis and dermis. Insufficient hydration can lead to a range of dermatological issues, including a dry and flaky skin surface, as well as irritation and inflammation. A decrease in moisture also results in diminished skin radiance and elasticity. This loss of elasticity impairs the skin's ability to maintain its shape, leading to the development of fine lines and wrinkles. Skin hydration is influenced by various endogenous factors, including genetic predispositions, hormonal fluctuations, and intrinsic aging. Notably, the natural aging process contributes to a decline in hyaluronic acid (HA), a vital component of the extracellular matrix alongside collagen and elastin. Additionally, dietary and lifestyle choices—such as poor nutrition, alcohol, caffeine, and tobacco use can adversely affect skin moisture levels. Environmental factors, including dry air, air conditioning, wind, cold temperatures, and UV radiation, can also disrupt the skin's water balance.[1]

The growing demand for biocompatible, biodegradable, non-allergenic, and non-toxic cosmetic products reflects a significant trend in the beauty and skincare industry, driven by health and environmental concerns. Consumers are increasingly informed and seek transparency from brands about their formulations, favouring gentle ingredients. Advances in biotechnology and material science have enabled the development of effective biocompatible and biodegradable carriers. Additionally, ethical and sustainable manufacturing practices are becoming more important, with the industry striving to reduce its ecological footprint through eco-friendly packaging and ingredients. The rise of personalized skincare solutions and a

commitment to research and development further highlight the industry's focus on innovative and sustainable products.[2,3]

Facial masks, which are the most popular skincare treatments for enhancing skin appearance quickly. This segment is rapidly expanding within the prestige beauty market due to the beneficial properties of their formulations. Consumers are customizing their mask routines based on skin type and lifestyle. Sheet masks, designed for easy hydration and soothing, have become especially popular due to their attractive packaging, innovative marketing, and user-friendly application. Manufacturers are focusing on research and development to make these products accessible to a diverse range of consumers, with a variety of price points to ensure affordability. The market continues to evolve with different formats and formulations for maximum effectiveness.[4]

This facial sheet mask, enriched with soothing emollients and active ingredients like peptides and aloe vera, delivers profound nourishment. Figure 1 provides a detailed overview of this luxurious and highly effective skincare solution.

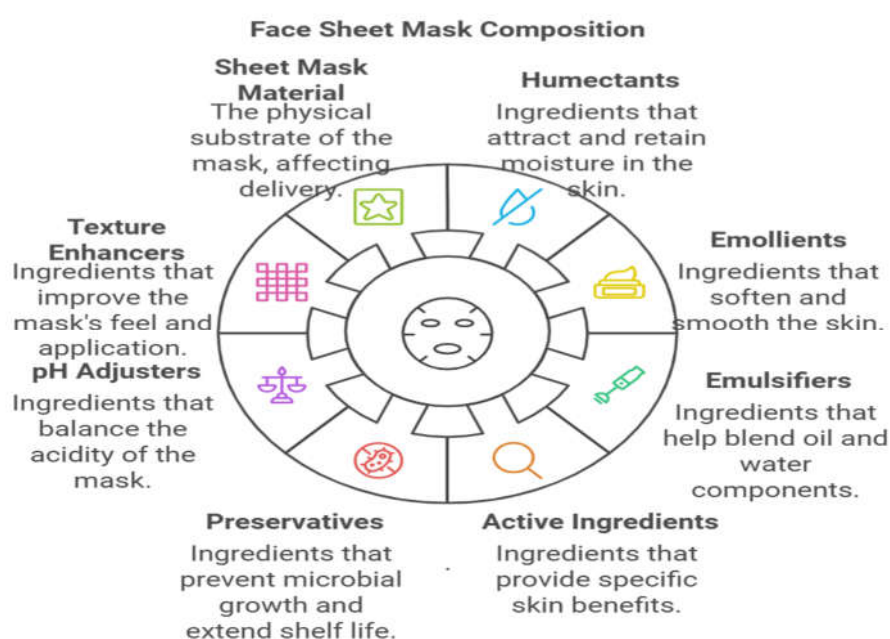


Figure 1 Face sheet composition

Face sheet masks are a popular skincare product known for their convenience and targeted benefits. They provide deep hydration, nourishment, and repair, while addressing concerns such as dry, sensitive, and acne-prone skin. However, they also come with challenges, including potential skin irritation and environmental impact. The strengths and challenges of face sheet masks are outlined in the Figure 2 below. [5-8]

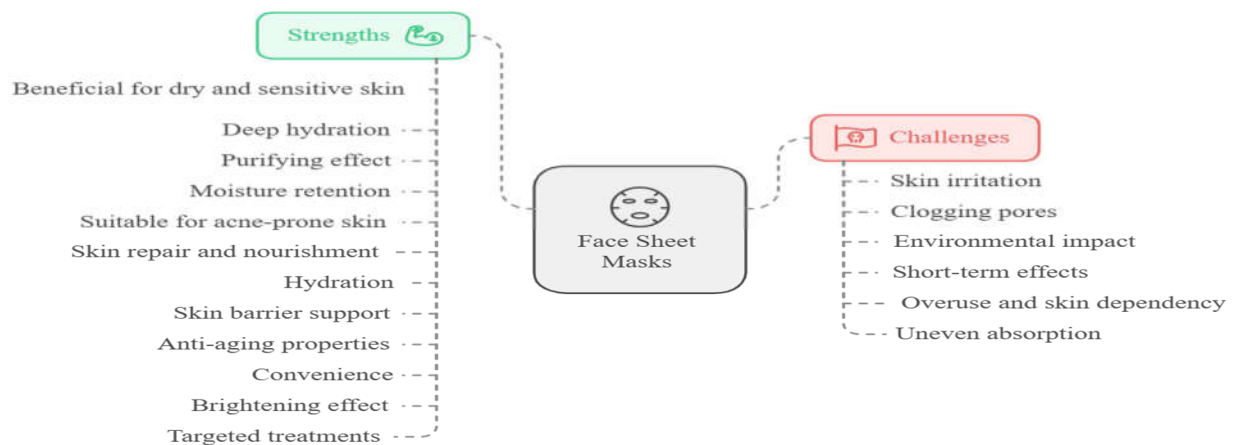


Figure 2 Strength and Challenges of face sheet mask

Face sheet masks come in a variety of types, each designed with specific materials to offer distinct benefits and levels of comfort. [9-12]

1. Cotton Sheets: These sheets, made from natural cotton, are soft and breathable. They are suitable for all skin types and are often used in hydrating or soothing masks.
2. Hydrogel Sheets: Characterized by a gel-like texture that adheres closely to the skin, these sheets enhance serum absorption. They are particularly beneficial for dry and sensitive skin, providing deep hydration.
3. Bio-Cellulose Sheets: Composed of fermented natural fibers, primarily derived from coconut, these sheets offer a snug fit. They are well-known for their superior adherence and effective serum delivery, making them ideal for sensitive skin.
4. Charcoal Sheets: Made with activated charcoal, these sheets help absorb excess oil and cleanse the pores. They are particularly suited for oily and acne-prone skin, providing a purifying effect.
5. Foil Sheets: Featuring an outer foil layer that retains heat, these sheets enhance serum absorption. They are best suited for intensive hydration, anti-aging, and moisture retention.
6. Clay Sheets: Combining the properties of clay with a sheet format, these masks dry on the skin. They help control oil and remove impurities, making them suitable for oily or acne-prone skin.
7. Bubble Sheets: These oxygenating masks create a foaming effect that provides a thorough cleanse. They are excellent for brightening and detoxifying, suitable for all skin types.
8. Tencel Sheets: Crafted from sustainably sourced wood pulp, these eco-friendly and biodegradable sheets are smooth and soft, catering to sensitive skin and environmentally conscious users.
9. Silk Sheets: These extremely thin and gentle sheets are often infused with amino acids for skin repair. Known for their luxurious feel, they are ideal for delicate and sensitive skin.
10. Microfiber Sheets: Made from fine, tightly woven fibers that help retain moisture, these sheets provide excellent adherence and are typically found in high-end nourishing masks.
11. Bamboo Sheets: Produced from bamboo fibers, these sheets are recognized for their antibacterial properties.

This Figure 3 illustrates the various types of face sheet masks, each designed with unique materials to offer distinct benefits.



Figure 3 . Types of Face Sheet Mask

The table provides a comprehensive summary of a range of botanical, herbal, fruit, vegetable, marine, and other plant-based components frequently employed in skincare face sheet masks. It encompasses details regarding the specific plant parts used, the main benefits associated with each ingredient, commercial brands that incorporate these elements, and reference numbers for additional research. The ingredients featured in this table are recognized for their varied and advantageous properties, including antioxidant, anti-inflammatory, moisturizing, anti-aging, and skin-brightening effects, among others. These components are routinely integrated into skincare products to enhance the appearance of healthy, radiant, and youthful skin.

| Sr no. | Botanical Ingredient | Plant part utilized | Primary Effects | Commercial Brand | Ref no. |
|--------|---|---------------------|--|--|---------|
| 1. | Calendula (<i>Calendula officinalis</i>) | Flower | Reduces redness and irritation, maintains hydration, and prevents dryness. Supports skin repair, is rich in antioxidants, has antibacterial properties, improves skin tone, and reduces dullness. | 1. I DewCare 2.MasKing 3. Puca - Pure and Care 4.The Face Shop 5.Baroness 6.AllMask | [13] |
| 2. | Camellia (<i>Camellia sinensis</i> , <i>Camellia japonica</i>) | Flower | Antioxidant properties, calming relief, enhanced hydration, youthful radiance, skin illumination, oil regulation, and protection against UV rays. | 1.Olay 2.Nutriherbs 3SimplyWhen 4.Cindynal | [14] |
| 3. | Chamomile: German (<i>Matricaria chamomilla</i>) Roman (<i>Chamaemelum nobile</i>) | Flower | Soothes inflamed skin, reduces redness and swelling, offers antioxidant protection, nourishes and hydrates, and promotes brightness and an even tone. | 1.Nature Republic 2.Petitfee 3.Good Vibes 4.MyGlamm 5.HudaBeuty6.MondSub 7.Bioaqua 8.POPxo | [15] |
| 4. | Hibiscus (<i>Hibiscus rosa-sinensis</i>) | Flower | Hibiscus deeply hydrates skin, enhancing softness and elasticity while reducing fine lines. It gently exfoliates, stimulates collagen for firmness, promotes an even tone, soothes irritation redness. | 1.Keya Seth 2.Masking 3.Grasindoshop 4.eBay 5.PureDew 6.Soonhan 7.Vitamasques | [16] |
| 5. | Jamine(<i>Jasminum</i>) | Flower | Jasmine hydrates, prevents dryness, protects against damage, soothes irritation, reduces redness, fights acne, and enhances skin tone for a luminous look. | 1.Shills 2.JMsolution 3.Organic Harvest 4.SKINmaman 5.Ted Baker | [17] |
| 6. | Lavender (<i>Lavandula angustifolia</i>) | Flower | Relaxing, Antibacterial,Moisturizing, Antioxidant, Protective, Aromatherapy Benefits. | 1.The Face Shop Real Nature 2,Garnier Lavender 3.Sephora 4.Nyka 5.Mancode 6.Jaquine | [18] |
| 7. | Lotus (<i>Nelumbo nucifera</i>) | Flower | Moisture Retention, Free Radical Defense, Calming, Age-Defying, Skin Illuminating. | 1.Real Nature 2.Masking 3.Glimmer 4.Rovectin 5.Lotus | [19] |
| 8. | Magnolia (<i>Magnolia officinalis</i>) | Flower | Antioxidant and anti-inflammatory properties, fights acne bacteria, brightens skin, offers anti-aging benefits, and provides hydration. | 1.Masking 2.Mamonde | [20] |
| 9. | Marigold (<i>Calendula officinalis</i>) | Flower | Promotes wound healing with anti-inflammatory benefits, enhanced moisturization, antioxidants, and anti- | 1.Baroness 2.I Dew Care 3.Real Nature | [21] |

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| | | | aging and antimicrobial effects. | 4.PUCA | |
| 10. | Rose (<i>Rosa damascena</i>) | Flower | Hydration, anti-inflammatory, and antioxidant benefits promote anti-aging effects, along with brightening and calming fragrances. | 1.Masking 2.Baroness 3.TNW 4.Nature Republic 5.Jasquiline | [22] |
| 11. | Sakura (<i>Prunus serrulata</i>) | Flower | Skin Illuminating Anti-Aging Moisturization Calming UV Defense. | 1.Garnier 2.Boots 3.Misumi 4.Laikou | [23] |
| 12. | Sunflower(<i>Helianthus annuus</i>) | Flower | Soothing Hydrating Antioxidant Protection: Anti-Inflammatory Benefits. | 1.Hellow Glow 2.Mask Book 3.Natural Vegan | [24] |
| 13. | Apple(<i>Malus domestica</i>) | Fruit | Moisturization, Age-Defying, Radiance Enhancement, Skin Restoration, Nutritional Support. | 1.Mooyam 2.Sadoer 3.Miniso 4.Puttisu 5.Skinella | [25] |
| 14. | Banana (<i>Musa spp</i>) | Fruit | Provides intense hydration and nourishment to the skin. Enhances moisture retention and promotes elasticity. | 1.Solimo 2.Masking 3.Disunie 4.Quret | [26] |
| 15. | Blueberry (<i>Vaccinium spp.</i> | Fruit | Rich in antioxidants, this formula protects against aging, boosts skin elasticity, and aids in damage repair. | 1.Mirabelle, 2.Himalaya 3.Dr . Rashel 4. Keya Seth 5. Real nature | [27] |
| 16. | Cherry(<i>Prunus avium</i>) | Fruit | Brightens skin, reduces dark spots, and offers anti-aging benefits with antioxidants. | 1.Quench 2.MondSub 3.Chansi 4.Frudia 5.Enokii | [28] |
| 17. | Coconut(<i>Cocos nucifera</i>) | Fruit | Delivers intense hydration, softens skin, and soothes dryness and irritation. | 1.MamaEarth 2.Tonymoly 3.Ponds 4.Dr.Rashel 5.Newest 6.Adbeni | [29] |
| 18. | Fig (<i>Ficus carica</i>) | Fruit | Promotes skin regeneration and reduces imperfections while moisturizing and improving elasticity. | 1.Skinella 2.Goodvibes 3.Farm skin 4.Dermika | [30] |
| 19. | Grape (<i>Vitis vinifera</i>) | Fruit | Protects skin with vitamins and antioxidants. Reduces fine lines and boosts radiance. | 1.Puttisu 2.Dermal 3.Tonymoly 4.Garnier 5.Saem | [30] |

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|-----|---|-------|--|---|------|
| 20. | Kiwi (<i>Actinidia deliciosa</i>) | Fruit | Boosts skin radiance and promotes an even complexion with vitamin C for collagen support. | 1.Lakme 2.Masking 3.GoodVibes 4.Dr.Rashel 5.Enokii 6.Bioaqu | [30] |
| 28. | Watermelon (<i>Citrullus lanatus</i>) | Fruit | Moisturizes and revitalizes the skin. Alleviates redness and discomfort through its soothing characteristics. | 1.Lakme 2.Twasa 3.Tonmoly 4.Seer Secrets 5.Sephora | [30] |
| 21. | Lemon (<i>Citrus limon</i>) | Fruit | Boosts brightness and reduces pigmentation while acting as a natural astringent to decrease oiliness and acne. | 1.Lakme, 2.Likewise 3.Gemblue 4.Dr. Rashel , 5.Shills 6.Tonymoly, 7.Twasa 8.Mirabelle 10.Pond's | [31] |
| 22. | Mango (<i>Mangifera indica</i>) | Fruit | Moisturizes and softens skin, rich in vitamin A for healthy skin rejuvenation. | 1.Moika 2.Farmstay 3.Mooyam, 4.Purelyf, 5.Mond'sub 6.Sephora | [32] |
| 23. | Orange (<i>Citrus sinensis</i>) | Fruit | Revitalizes dull skin with vitamin C for improved texture and complexion. | 1.Goodvibes 2.Gemblue 3.Khadi 4.T.N.W. 5.Pond's 6.Lakme 7.Garnier | [33] |
| 24. | Papaya (<i>Carica papaya</i>) | Fruit | Removes dead skin cells through the action of natural enzymes. Enhances skin brightness and texture. | 1.Mirabelle 2.Moxtale, 3.Newest, 4.TNW 5.Sanfe, 6.Nykaa, 7.Dr. Rashel | [34] |
| 25. | Pineapple (<i>Ananas comosus</i>) | Fruit | Delicately removes dead skin cells using natural enzymes. Enhances radiance and promotes a uniform complexion. | 1.Pond's 2.Tonymoly, 3.Sephora | [35] |
| 26. | Pomegranate (<i>Punica granatum</i>) | Fruit | Abundant in antioxidants, contributing to anti-aging benefits. Enhances hydration and boosts skin elasticity. | 1.Farm stay 2.Glimmer 3.Masking 4.Mask queen 5.Khadi essentials, 6.Baroneess, | [36] |

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| | | | | 7.Nykaa, | |
| 27. | Strawberry(<i>Fragaria × ananassa</i>) | Fruit | Enhances skin tone and diminishes pigmentation. Abundant in vitamin C, it fosters a luminous complexion. | 1.Lakme 2.Nykaa 3.Shills 4.Himalaya 5.Masking 6.Olivia | [37] |
| 29. | Beetroot(<i>Beta vulgaris</i>) | Vegetable | Beetroot helps lighten skin, reduce dark spots and uneven pigmentation, unclog pores, and exfoliate dead skin . | 1.Lightening 2.Jaquiline 3.Vegan 4.Masking | [38] |
| 30. | Mushroom <i>Ganoderma</i> | Vegetable | Hydration for anti-aging, brightening, anti-inflammatory, and antioxidant benefits. | 1.Mad Beauty 2.Elishacoy | [39] |
| 31. | Okra (<i>Abelmoschus esculentus</i>) | Vegetable | Moisturizing, Age-Defying, Calming Skin Restoration. | 1.FanBeauty 2.Jayjun 3.Ibutsuki | [40] |
| 32. | Onion (<i>Allium cepa</i>) | Vegetable | Antioxidant Defense, Anti-inflammatory, Antimicrobial, Wrinkle Reduction | 1.Dr.Rashel | [41] |
| 33. | Yam (<i>Dioscorea</i>) | Vegetable | Hydrating the skin, combating aging, boosting radiance, and reducing inflammation. | 1.Masking 2.Ovale 3.Karuna | [42] |
| 34. | Green Tea(<i>Camellia sinensis</i>) | Leaf | Antioxidant-rich, reduces inflammation, and protects skin from free radicals. | 1.Garnier 2.Swiss Beauty 3.The Face Shop 4.Twasa | [43] |
| 35. | Brahmi(<i>Centella Asiatica</i>) | Leaf | Calms inflamed skin, encourages recovery, and enhances moisture retention. | 1.Centella 2.Natural | [44] |
| 36. | Pearl Extract(<i>Pinctada maxima</i>) | Marine Extract | Skin Brightening, Anti-Aging, Hydration, Exfoliation, Soothing Properties, and UV Protection. | 1.UltraV 2.Nykaa 3.JMSolution 4.Quench | [45] |
| 37. | Seaweed <i>Laminaria japonica</i>) | Marine Plant | Moisturization, Age-Defying, Soothing and Relaxing, Illuminating, Purifying. | 1.Twasa 2.Tonymoly 3.The Body Shop 4.Senana 5.Purple | [46] |
| 38. | Alovera(<i>Aloe barbadensis miller</i>) | Plant | Hydration , Age-Defying Dermal Repair ,Soothing Sensation | 1.Mirabelle 2.Dr.Rashel 3.Chelica 4.Real Nature 5.CALA 6.Twasa 7.KBeuty 8.Dear She | [47] |

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| 39. | Snail Mucin (<i>Achatina fulica</i>) | Animal Derivative | 1. Moisturization, Skin Restoration, Age-Defying, Renewal, Free Radical Protection, Calming, Acne Management. | 1.Bioaqa 2.COSRX 3.D-Tan 4.Revuele 5.Orjena 6.Tonmoly 7.Mothermed 8.Mirabella 9.Twasa | [48] |
| 40. | Collagen(<i>Hydrolyzed Collagen</i>) | Animal Derivative | Moisture Retention Skin Elasticity Age-Defying Healing Enhancement Radiance Improvement. | 1.WildGlow 2.BAKE 3.UltraV 4.Biodance 5.Swiss Beuty 6.O3+ 7.Its Skin 8.CosDerma | [49] |
| 41. | Propolis | Animal Derivative (Resin extract) | Antibacterial, antifungal, anti-inflammatory, antioxidant, hydrating, restorative, and skin-brightening properties. | 1.IYOU 2.Lapcos 3. Tonymoly 4.CosRx 5.SkinFood 6.Apivita 7.Banila 8.Dr.Ceuracel | [50] |
| 42. | Rice(<i>Oryza sativa</i>) | Fermented Ingredient | Enhancing Skin Radiance, Moisturization, Age-Defying Benefits, Calming Effects, and Oil Regulation. | 1.MamaEarth 2.The Face Shop 3.SwisBeuty 4.Real Nature 5.Orjena 6.TonyMoly 7.OroGold | [29] |
| 43. | Kombucha | Fermented Ingredient | Anti-Aging Hydration Enhancing Brightness Detoxifying Soothing and Restorative Effects. | 1.InnsFree 2.TAC 3.Danielle 4.CremeShop 5.Naturak Skin | [51] |
| 44. | Charcoal | Minerals | Detoxification, thorough cleansing, exfoliation, acne treatment, oil control, and calming effects. | 1.RealNature 2.Sara 3.SwissBeauty 4.O3+ 5.Klairs 6.Dr.Rashel 7.Garnier 8.Nykaa 9.Sanfe 10.Ponds | [52] |
| 45. | Gold Aurum (Au) | Minerals | Properties that Combat Aging Anti-Inflammatory Benefits Skin Brightening | 1.Nyka 2.DoppelTree | [53] |

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|-----|--|---------------------------|---|--|------|
| | | | Enhances blood circulation, resulting in a luminous and vibrant complexion. Diminishes pigmentation and dark spots. detoxification. | 3.O3+ 4.GoodVibes 5.Mooyam 6. Twasa 7. Banobagi 8. Skin79 9.Mirabelle 10.JoLee 11.MyGlam 12.MoonStar | |
| 46. | Silver <i>Silver nanoparticles (AgNPs)</i> | Minerals | Antimicrobial, Anti-inflammatory, Wound Healing, Skin Purification Calming Effects | 1.Klaris 2. O3+ 3. Loreal 4. OOTD 5.VLCC 6.Asaya 7.GoodVibes 8.InnisFree 9.AllMask | [54] |
| 47. | Hyaluronic Acid (<i>hyaluronan</i>) And Peptides (<i>palmitoyl pentapeptide</i>) | Chemical | Intense Moisture Infusion Barrier Enhancement Rejuvenating & Soothing Appearance Benefits | 1.Meiheal 2.Lakme 3.InnisFree 4.WildGlow 5.DermaFique 6.Glamveda 7.Dr.Rashel 8. Loreal 9.Ganier 10.TonyMoly 11.Twasa 12.Bake | [55] |
| 48. | Vitamin (C,E,B3,B5,A,K,D,B6,B12,F) | Vitamin | Enhances skin luminosity and diminishes pigmentation. Provides hydration and safeguards against environmental harm. | 1.Ponds 2.SkinFormula 3. Mirabelle 4.Jaquiline 5.Garnier 6.The Man Company 7.O3+ 8. Dr.Rashel 9.Lakme 10.Quench 11.InnisFree 12. The BodyShop | [56] |
| 49. | Ceramide | Biotechnology Derivatives | Skin Barrier Restoration & Hydration, Anti-Aging Calming Effects, Supports Eczema, Psoriasis, and Compromised Skin | 1.Nacific 2.InnisFree 3.Bake 4.CosRx 5.OOTD 6.TonoMoly | [57] |

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|-----|---|----------------------|---|--|------|
| | | | | 7.Jaqualane 8.MondSub 9.Arcellia | |
| 50. | Honey (<i>Apis mellifera</i>) | Sugar Based | Properties of Hydration, Antioxidants, Antibacterial Effects, Soothing Qualities, and Wound Healing. | 1.RealNature 2.FarmStay 3.Some By Me 4.Sadoer 5.Adbeni 6.Lapcos 7.Ayouthveda 8.Its Skin 9. Gemblue | [58] |
| 51. | Licorice Root (<i>Glycyrrhiza glabra</i>) | Extract | Skin Lightening Anti-inflammatory Antioxidant Moisturizing Age-Defying Hyperpigmentation . | 1.Ayouthveda 2.Olivia 3.JustHerb 4.Masking | [59] |
| 52. | Caffeine (1,3,7-trimethylxanthine.) | Extract | Anti-inflammatory,anti-aging benefits, enhancement of circulation, reduction of puffiness and dark circles, antioxidant characteristics, and cellulite reduction. | 1.Newest 2.MCaffine 3.GoodVibes 4.Dr.Rashel 5.JustHerb 6.Ayouthveda 7.CosDerma | [60] |
| 53. | Yeast | Extract | Hydration,Anti-Aging, Restoration of Skin Barrier, Soothing,Against Free Radicals. | 1.BioAqua 2.OLAY 3.BIO UP | [61] |
| 54. | Edelweiss Stem (<i>Leontopodium</i>) | Stem | Antioxidant properties, anti-aging benefits, skin rejuvenation, hydration, and anti-inflammatory effects. | 1.The Body Shop 2.Himalaya 3.Plink 4.Sparkle Youth 5. Ebanel | [61] |
| 55. | Coenzyme Q10 or Ubiquinone | BioActive Ingredient | Antioxidant Protection Minimizes the appearance of fine lines and wrinkles Enhances skin cell regeneration Provides hydration and moisture Alleviates inflammation. | 1.Baroness 2.Dermal 3.BioCrown 4.O2Bubble 5.NIVEA 6.Diazo 7.MondSub 8. Chicnutics 9.Lebelage 10.FaceFacts | [61] |

Evaluation of Product Performance [62-63]**1. Organoleptic Evaluation**

Assess the physical properties, fragrance, and coloration of the formulation.

2. pH Measurement

Utilize a calibrated pH meter to determine the pH of the formulation. Create a 1% solution by dissolving 1 g of the formulation in 100 ml of distilled water and submerge the electrode.

3. Homogeneity Assessment

Apply a designated quantity of the formulation onto two transparent surfaces, ensuring even distribution without the presence of coarse particles.

4. Stability Testing

Store the formulation at 4°C for 24 hours, followed by 40°C for another 24 hours. Repeat this cycle to assess stability.

5. Irritation Assessment

Position a cut sheet mask (2.5 cm) behind the ear and monitor for any signs of irritation, such as redness, itching, or swelling.

6. Spreadability Test

Place a small serum sample on a watch glass, apply a weight of 100 g, and time how long it takes to spread 4 cm within 60 seconds. Calculate using the formula:

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

7. Microbial Examination

Conduct the agar well-diffusion method. Inoculate plates with bacteria, introduce serum and Ciprofloxacin into the wells, and incubate at 37°C for 24 hours. Measure the diameter of the inhibition zone.

8. Cyclical Temperature

Simulate temperature variations by alternating between room temperature and freezing conditions on a daily basis.

9. Viscosity Determination

Determine viscosity with a viscometer, ensuring it falls within the range of 1 to 30 mPas for water-based serum.

10. Sheet Absorbance

Immerse a cotton sheet in serum and evaluate its absorption capacity. Calculate swelling using the formula:

$$\text{Swelling} = (G_{s,t} - G_i) / G_i$$

11. Soaking Time

Soak the cotton sheet in serum for different durations and document absorption at intervals to identify the optimal saturation time.

12. Hedonic Test

Perform a preference assessment to gauge panelists' subjective evaluations and sensory attributes of the formulation.

Conflict of Interest

The authors declare no conflict of interest.

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