

A Review on Formulation and Evaluation of Polyherbal Face-Sheet Mask

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Abstract

This research focuses on the formulation and evaluation of a polyherbal face-sheet mask developed using natural herbal ingredients to address common skin concerns such as acne, dullness, pigmentation, sun damage, dark spots, and uneven skin tone. With the increasing demand for safe, eco-friendly, and chemical-free skincare products, herbal-based cosmetic formulations have gained significant attention due to their therapeutic properties, minimal side effects, and enhanced consumer acceptance. Face-sheet masks are widely recognized as an effective topical delivery system because they provide prolonged skin contact, improve hydration, and facilitate better penetration of bioactive compounds into the skin. The present formulation incorporates a combination of medicinal plant extracts selected for their complementary dermatological benefits. Dragon fruit extract serves as a rich source of antioxidants and vitamins that protect the skin against oxidative stress and premature aging. Kiwi extract enhances skin brightness and supports collagen synthesis owing to its high vitamin C content. Papaya extract contains natural enzymes that gently exfoliate dead skin cells, promoting smoother and more radiant skin. Lemongrass extract exhibits potent antimicrobial and antiseptic properties, making it beneficial in preventing acne-causing microorganisms. Green tea extract contributes strong antioxidant and anti-inflammatory activities that help reduce redness, irritation, and environmental damage. Vitamin E oil protects the skin from free radical-induced damage while improving skin elasticity and reducing signs of aging. Glycerin functions as an effective humectant by attracting and retaining moisture, thereby maintaining skin hydration, softness, and suppleness. Rose oil provides soothing, moisturizing, and calming effects that improve the overall sensory appeal of the formulation. The prepared polyherbal face-sheet mask aims to provide hydration, nourishment, skin rejuvenation, and protection through the synergistic action of these natural ingredients. To ensure the quality, safety, and efficacy of the formulation, comprehensive evaluation studies were conducted, including assessment of organoleptic characteristics, pH, spreadability, sheet absorption capacity, serum retention, skin irritancy, and stability under suitable storage conditions. The findings suggest that the formulated polyherbal face-sheet mask possesses desirable physicochemical properties, good stability, and excellent skin compatibility, making it a promising natural skincare product with potential applications in cosmetic and dermatological care.

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INTRODUCTION

Natural cosmetics are beauty products formulated from natural herbs that support the care and enhancement of appearance and personality. Applied externally, they help cleanse, nourish, and beautify the body. Free from harsh chemicals, these products provide gentle care using nature-based ingredients. Their purpose is to promote healthy

skin, improve looks, and serve as a safe, environmentally friendly option for personal care and grooming [1].

STRUCTURE OF SKIN

The skin is made up of different layers: The epidermis, which is the outermost layer, just beneath it lies the basement membrane, below its Dermis layer. Below the dermis is the hypodermis layer (Figure 1) [2].

- **Epidermis Layer:** The epidermis, which forms the outermost layer of the skin, is a stratified squamous epithelium mainly made up of keratinocytes. These keratinocytes are the primary cells of the epidermis and are responsible for producing keratin, a structural protein that gives strength to the skin. *There are 5 layers of epidermis:* Stratum corneum, Stratum lucidum, Stratum granulosum, Stratum spinosum, Stratum Basale [3].
- **Basement Membrane:** The basement membrane lies beneath the epidermis and serves as a boundary between the epidermis and dermis. It contains extracellular matrix molecules on both sides that create an adhesive environment, ensuring a firm connection between these two layers. It is made up of two distinct parts:
 - *Lamina lucida.*
 - *Lamina densa* [3].
- **Dermis Layer:** The dermis is often referred to as the “core” of the integumentary system, distinguishing it from the epidermis (epi– meaning “upon” or “over”). It is thicker than the epidermis and contains nerves and blood vessels that provide nourishment and support to the upper skin layer. Structurally, the dermis is divided into two main regions:
 - *Papillary dermis.*
 - *Reticular dermis* [3].
- **Hypodermis:** The hypodermis, also called the subcutaneous layer or superficial fascia, lies beneath the dermis and connects it to the fascia covering muscles or bones. This layer is primarily made up of adipose (fat) tissue, which serves as a storage site for fat and helps in cushioning and insulating the body [3].

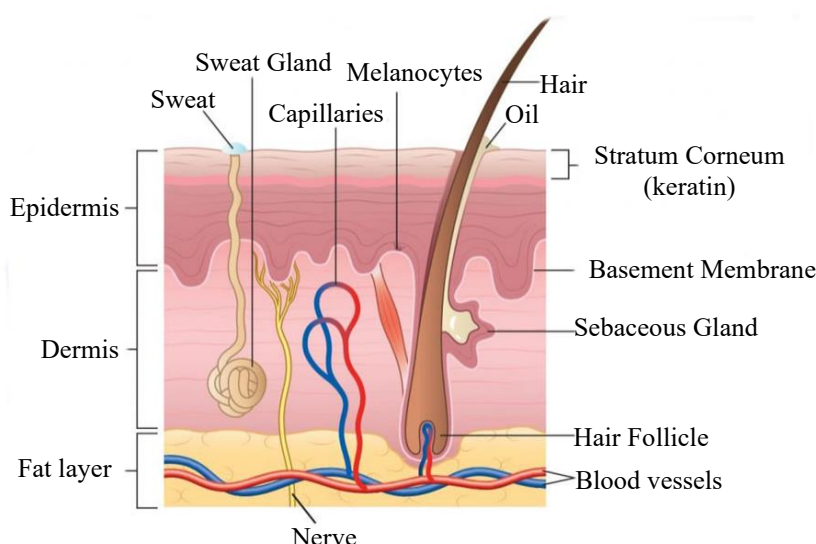


Figure 1. Structure of skin.

TYPE OF COSMETIC FORMULATION

Cosmetic formulations are generally grouped into three main types: Solid, Semi-solid, and Liquid.

- Solid cosmetics include products, such as face packs, facial masks, talcum powders, and compact powders, which are applied in dry form.

- Semi-solid formulations consist of items like creams, ointments, liniments, and wax-based creams, typically used for moisturizing or therapeutic purposes.
- Liquid cosmetics cover a wide range of products, including shampoos, mouthwashes, deodorants, hair oils, conditioners, moisturizers, cleansing milk, sprays, and liniments, which are usually fluid in nature and easy to apply [4].

Face-Sheet Mask

Along with various cosmetics product, Face-sheet masks have gained popularity in skincare due to their convenience, quick results, and attractive appearance (Figure 2). These masks are usually made from fabric or bio cellulose material infused with serums rich in active ingredients. When applied, they create a barrier that helps the skin absorb nutrients more effectively. Their ability to deeply hydrate and nourish the skin in a short time makes them ideal for busy users [5].



Figure 2. Face-sheet mask.

Serum

Serum is a highly concentrated skincare product that is widely used in cosmetology. The term itself has become a professional concept in this field. Compared to regular creams, serums are far more potent, often containing up to ten times more active ingredients. Because of this high concentration, they can address skin concerns more effectively and in less time. With the rising global cost of living, the demand for cosmetic products has increased, as many people are eager to maintain a youthful and attractive appearance. A well-formulated serum can improve skin firmness, refine texture, minimize the appearance of pores, and enhance hydration [6].

Steps to Use Face-Sheet Mask

- *Soaking Face-Sheet Mask* – Before applying a sheet mask, it should be soaked in serum for about 10–15 minutes to ensure the fabric is fully infused.
- *Begin with Cleansing Your Skin* – Before starting any skincare routine, it is important to wash your face thoroughly. Choose a mild facial cleanser and use lukewarm water to gently remove oil, dirt, and impurities without causing irritation.
- *Use a Toner* – Once you have cleansed your face, the following step is to apply toner. A toner revitalizes the skin, clears away any remaining traces of dirt or cleanser, and helps maintain the skin's natural pH level.
- *Placing the Sheet Mask* – Begin by positioning the sheet mask on your face, starting from the forehead and then aligning it carefully over the eyes, nose, mouth, and chin. Smooth it outward with gentle motions to remove any folds or air bubbles so the mask adheres closely to the skin.
- *Relax for 20 Minutes* – Leave the mask on for about 20 minutes without shifting it.

- **Remove Face-Sheet Mask** – After Removing the Sheet Mask do not wash your face once you take off the mask. Instead of cleansing it away, gently pat the remaining product into your skin with your fingertips until it is mostly absorbed.
- **Apply Eye Cream or Moisturizer:** To complete your skincare routine, you may apply an eye cream and a moisturizer to seal in the nutrients and hydration, support skin cell renewal, and boost overall radiance. Adjust this step based on your skin's needs and comfort (Figure 3) [7].

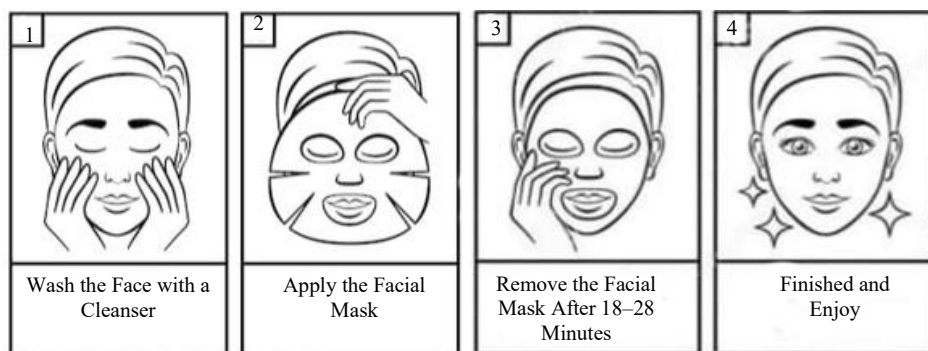


Figure 3. Steps to apply face-sheet mask.

MATERIAL AND METHODOLOGY

Plant material consists of natural substances obtained from plants, which are included in formulations to help improve the performance and benefits of the final product. The ingredients used are listed below:

- Dragon fruit extract.
- Kiwi Pulp Extract.
- Lemongrass Extract.
- Green tea Extract.
- Papaya fruit Extract.
- Glycerine.
- Rose oil.

Dragon Fruit

- **Biological Name** – *Selenicereus undatus* or *Hylocereus undatus*
- **Family** – Cactaceae
- **Phytoconstituents** – The phytochemicals present in dragon fruit or pitaya include carbohydrates, proteins, saponins, phenolic compounds, terpenoids, oils, flavonoids, tannins, phenols, coumarin, and steroids [8].

Dragon fruit, or pitaya, is the fruit of tropical climbing plants from the genus *Hylocereus* in the cactus family (Cactaceae). These fruits are unique for their striking shapes and a variety of skin and flesh color combinations, including red with pink, white with pink, red-purple, or yellow with white. Their vibrant appearance and diversity distinguish pitayas as unusual tropical fruits [9].

Kiwi Fruit Extract

- **Biological Name** – *Actinidia deliciosa*.
- **Family** – Actinidiaceae.
- **Phytoconstituents** – Kiwifruit contains a wide variety of beneficial phytochemicals, including triterpenoids, saponins, and several types of phenolic compounds such as flavonoids, polyphenols, anthraquinones, and coumarins. It is also rich in essential vitamins and minerals, contributing to its nutritional and health-promoting properties [10].

Kiwifruit, also known as Chinese gooseberry, is the edible fruit of several climbing plants from the *Actinidia* genus. The most popular cultivated type is *Actinidia deliciosa* “Hayward”, which is roughly

egg-shaped, measuring about 5 to 8 centimetres long and 4.5 to 5.5 centimetres wide. It has a thin, fuzzy, brown outer skin that's slightly tart yet edible [11].

Lemon Grass Extract

- *Biological Name* – *Cymbopogon flexuosus*.
- *Family* – Poaceae.
- *Phytoconstituents* – Lemongrass leaves are packed with various bioactive compounds, such as alkaloids, flavonoids, terpenoids, saponins, phenols, and tannins, which together contribute to their unique flavor and aroma [12].

Lemongrass leaves are commonly brewed into tea and, in Brazil, are widely used for their pain-relieving, fever-reducing, antispasmodic, calming, anti-inflammatory, and diuretic effects. On a dry weight basis, the plant contains about 1–2% essential oil [13].

Green Tea Extract

- *Biological Name* – *Camellia sinensis*.
- *Family* – Theaceae.
- *Phytoconstituents* – The main chemical constituents of green tea are phenols, alkaloids, Flavonoids, tannins and steroids. About one third part of green tea is made up of polyphenols which include catechins like epigallocatechin gallate (EGCG), epigallocatechin (EGC), epicatechin-3-gallate, and epicatechin (EC). Besides these polyphenols others are flavonoids and their glycosidic derivatives that are carotenoids, quinic acid, chlorogenic acids [14, 15].

Tea is the second most widely consumed beverage in the world. When natural ingredients, like tea, are incorporated into cosmetic formulations, they help ensure both safety and product quality. Tea is rich in polyphenols, catechins, flavonoids, and antioxidants, which play a vital role in protecting the skin from damage, slowing premature aging, preventing infections, regulating sebum production, and minimizing signs of aging such as hyperpigmentation and fine lines [16, 17].

Papaya Fruit Extract

- *Biological Name* – *Carica papaya* L.
- *Family* – Caricaceae
- *Phytoconstituents* – Phytochemical present in papaya like alkaloids, carotenoids, flavonoids, kaempferol, myricetin, quercetin and carotenoids – lycopene, zeaxanthin, cryptoxanthin, β -carotene and violaxanthin, and vitamins [18].

Papaya powder is known for its soothing effects on damaged skin and is beneficial in treating sunburns due to its high content of natural healing enzymes. The flavonoids in papaya help stimulate collagen production, which contributes to making the skin feel firmer, softer, and more elastic [19].

Rose Oil

- *Biological Name* – *Rosa damascena*
- *Family* – Rosaceae
- Rose oil, derived from *Rosa damascena* and *Rosa centifolia* of the Rosaceae family, was first discovered in ancient Persia and has long been valued for its skin benefits. Traditionally used in facial and skincare remedies, rose oil is known for its moisturizing properties [20].

Glycerin

In the formulation, 4–5 drops of glycerin were added to act as a moisturizing agent. As a humectant, glycerin draws moisture from the surrounding environment and locks it into the skin, helping to keep it hydrated, supple, and protected from dryness. In a peel-off mask, it not only boosts skin moisture retention but also creates a protective layer that shields against environmental factors like pollution and harsh weather, strengthening the skin's natural defences [21].

Methodology of Face-Sheet Mask

- The serum formulation and sheet mask soaking process began with the complete sterilization of all equipment and glassware to maintain hygiene and avoid contamination.
- First, the aqueous phase was prepared by mixing distilled water, glycerin, green tea extract, and selected fruit extracts (dragon fruit, kiwi, and papaya) in a clean beaker.
- Continuously stirred the with a magnetic stirrer for about 15–20 minutes to ensure even blending.
- Next, lemongrass extract and Tween 20 were gently added to the mixture while maintaining constant stirring to achieve proper solubilization and a stable emulsion.
- In a separate container, the oil phase – containing vitamin E oil and rose oil – was prepared and then slowly incorporated into the aqueous mixture while stirring at moderate speed, resulting in a uniform emulsion.
- To improve the consistency and homogeneity of the serum, this final blend was stirred for an additional 30 minutes.
- Once the serum was ready, pre-cut biodegradable sheet masks made from cotton or cellulose were sterilized and placed into clean containers.
- The prepared herbal serum was pored over the masks until they were fully saturated, then left at room temperature for 2–3 hours to allow complete absorption.
- Finally, each mask was individually packed in airtight, sterilized pouches for storage [22].
- The ingredients quantities are given in Table 1.

Table 1. Formulation of herbal sheet mask.

S.N.	Ingredients	Quantity	Properties
1	Dragon fruit extract	4.5 ml	Anti-oxidant.
2	Kiwi fruit extract	4.5 ml	Complexion enhancer.
3	Papaya fruit extract	4.5 ml	Exfoliation.
4	Lemon grass extract	3.0 ml	Anti-microbial agent.
5	Green tea	4.5 ml	Anti-inflammatory agent.
6	Glycerin	6.0 ml	Humectant, Moisturizer.
7	Rose oil	2.0 ml	Soothing agent.
8	Vitamin E oil	3.0 ml	Anti-aging.
9	Tween 20	1.0 ml	Emulsifier, stabilizer.
10	Distilled water	Q.S to 100 ml	Solvent.

Evaluation Parameter

- *Organoleptic Evaluation:* Assessing its color, odor, and texture. The appearance of the cream was evaluated based on its color and smoothness [22].
- *pH of the Serum:* The pH level is an important factor in determining how stable and effective the serum will be, as well as how well it works with the skin. Since healthy human skin usually has a slightly acidic pH between 3.5 and 6.5, a good serum should fall within this range. This helps support the skin's natural barrier and protects against harmful microbes. If the pH is too high or too low, it can cause problems like dryness, irritation, redness, or sensitivity [22].
- *Spreadability Assessment:* Spreadability is a key factor in evaluating the ease of serum application, as it influences how uniformly the product distributes over the skin, thereby affecting both user satisfaction and the effectiveness of the formulation. The glass slide technique is commonly employed for this purpose, where a measured amount of serum is placed between two slides, and the spread diameter is recorded. An ideal serum should demonstrate smooth and even spreading, ensuring proper skin coverage and improved delivery of active ingredients. The spreadability can be calculated using the formula:

$$\text{Spreadability (S)} = M \times L \times T$$

- M = weight applied to the upper slide.
- L = length of the glass slide.
- T = time taken (in seconds) [22].
- *Irritancy Evaluation*: The irritancy test is conducted to determine whether a serum may cause skin irritation or unwanted reactions. This step is particularly important for formulations intended for sensitive skin. The assessment can be carried out through patch tests on human volunteers or by using in vitro models such as reconstructed human epidermis. Indicators like redness, itching, or burning are observed over a defined time period. A formulation showing little to no irritant effect is considered more skin-friendly and safer for prolonged use [22].
- *Homogeneity*: When checking a serum, look for a uniform and smooth appearance. A properly blended serum should have an even texture throughout, without any clumps, lumps, or uneven patches [22].
- *Microbial Testing of the Formulated Serum*: It was performed to verify its safety and stability. For this, the serum was inoculated onto agar plates using the streak plate technique and incubated at 37°C for 24 hours. After incubation, the plates were inspected for any signs of microbial colonies and compared against a control plate containing no serum. This procedure helped determine both the antimicrobial activity of the serum and its potential role in promoting skin health [22].
- *Sheet Absorption*: To evaluate this, a cotton sheet is immersed in the serum to measure how much of the product it can take up and to assess how easily the serum gets absorbed by the sheet.

Table 2. Evaluation parameters & results.

S.N.	Evaluation parameters	Result
1	Organoleptic Evaluation	Color: Orange. Odor: Slightly sweet. Taste: Characteristic.
2	pH	The pH of serum is 3.5 pH.
3	Spreadability	The serum is Uniformly spreadable and shows Smooth texture.
4	Irritancy Evaluation	No irritation or allergic reaction like redness to skin.
5	Homogeneity	The nature of serum shows homogeneous nature.
6	Microbial Evaluation	No characteristic colonies are found.
7	Sheet absorbance	The absorbance of serum by sheet is good.

RESULT AND DISCUSSION

An herbal face-sheet mask was successfully developed by incorporating a blend of natural extracts to provide both cosmetic and therapeutic benefits. The mask's serum displayed excellent solubility and formed a uniform solution, allowing even distribution of active plant-derived ingredients across the sheet surface. The formulation maintained a skin-compatible pH range of 3.5–4.5, minimizing irritation risks and making it appropriate for regular use, even on sensitive skin. Post-application results showed smoother, refreshed skin with improved softness and glow. The synergistic action of multiple herbal extracts further boosted its efficacy by soothing irritation, aiding barrier restoration, and protecting skin from oxidative stress. Collectively, these effects elevated the mask's overall performance, establishing it as a versatile skincare solution [22].

CONCLUSION

The study aimed to develop a natural polyherbal sheet mask using plant-based extracts for targeted skin benefits. Dragon fruit provided antioxidant activity, kiwi enhanced complexion, papaya acted as an exfoliant, and lemongrass offered antimicrobial effects. Green tea extracts reduced inflammation, vitamin E oil supported anti-aging, glycerin ensured hydration and rose oil soothed and improved skin texture. Evaluation confirmed successful formulation, with stability testing recommending storage at room temperature. The sheet acted as a carrier, enhancing serum absorption. Applied two to three times weekly for 10–20 minutes, the mask improves skin brightness, reduces blemishes, and leaves a refreshed, glowing appearance.

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