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Research Paper

Standardization and Quality Assessment of a Plant-Based Powder Formulation

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ABSTRACT

Skin is one of the vital organs of the human body. Healthy skin plays an important role in our daily life. Sometimes the skin may become unhealthy due to various kinds of reasons. Different types of medicated formulations are used to protect the skin. Herbal powder is one of them. The present study aimed to formulate and evaluate a plant-based herbal powder intended for skincare applications. The formulation was prepared using Neem, Turmeric, Aloe vera, Tulsi, Chandan, Liquorice, Bamboo leaf, Honey, Rose water, and Multani mitti in suitable proportions to provide antimicrobial, anti-inflammatory, oil-absorbing, and soothing effects. The prepared formulation was evaluated for organoleptic characteristics, physicochemical parameters, phytochemical constituents, microbial contamination, and short-term stability. The results showed acceptable physical properties, skin-compatible pH, low moisture content, and absence of microbial growth. Phytochemical screening confirmed the presence of flavonoids, tannins, alkaloids, and phenolic compounds. The study concludes that the developed herbal powder is safe, stable, and effective for topical application. However, further long-term stability studies and clinical evaluations are recommended.

INTRODUCTION

The formulation and evaluation of herbal powders for skincare involve the development of natural cosmetic preparations using medicinal plant materials with therapeutic potential. Traditional systems such as Ayurveda have long utilized plant-based ingredients for maintaining skin health and treating various dermatological conditions. Herbal powders are composed of finely processed plant materials and are commonly used as topical applications, including face packs and cleansing

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agents. In recent years, there has been a growing preference for herbal cosmetics due to their natural origin, better skin compatibility, and relatively lower incidence of adverse effects compared to synthetic products. However, the variability in composition of herbal materials necessitates proper standardization to ensure consistency, quality, safety, and efficacy of the formulation. Standardization involves the evaluation of physicochemical, organoleptic, and microbiological parameters to establish quality control measures. Therefore, the present study focuses on the formulation and quality assessment of a plant-based powder using selected medicinal herbs. [1,2,3]

Table 1: Different types of skin problem

Sl. no	Types of skin problems
1.	Acne: - Acne is one of the most common skin problems in adults. It is caused by excess sebum production and blockage of hair follicles, leading to pimples, blackheads and whiteheads also some bacterial infection and inflammation cause acne.[4]
2.	Wrinkles: - Wrinkles are visible lines, folds, or creases that form on the skin due to aging, loss of collagen and elasticity. They commonly appear on the face, neck, and hands as the skin becomes thinner and less firm. Broad-spectrum sunscreen is help by blocking UVA and UVB.[5]
3.	Skin rashes: - Rashes are often itchy, painful and irritated skin on the body. Some variety of causes of skin rashes are bites, chicken pox, drug allergies etc. There is some important type of skin rashes like fleabites, fifth disease, rosacea, impetigo etc. [6]
4.	Dark circles: - Dark circles are darkened areas of skin that appear under the eyes due to factors such as lack of sleep, stress, aging, pigmentation, or poor blood circulation. They make the under-eye area look dull, tired, or discolored.[7]
5.	Black spot: - Hyperpigmentation is a skin condition occurred by producing more melanin as usual. There is no need any treatment but people choose treatment for cosmetic reasons.[8]
6.	Oily skin: - Producing too much oily substance known as sebum (natural oil) from the sebaceous glands. it results in a shiny appearance, enlarged pores, and increased tendency for acne and pimples. environmental factors are humidity.[9]

POWDER:

A powder is defined as a solid dosage form composed of finely divided drugs and/or excipients, intended for internal or external use. It is one of the oldest and simplest pharmaceutical preparations and serves as a fundamental dosage form in drug delivery systems. Powders may contain a single medicinal substance or a mixture of active pharmaceutical ingredients and suitable additives such as diluents, preservatives, or flavoring agents. Due to their large surface area, powders generally exhibit faster dissolution and enhanced bioavailability compared to other solid dosage forms like tablets and capsules.[10]

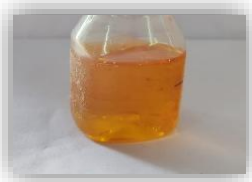
MATERIALS AND METHODOLOGY:

1. COLLECTION OF HERBAL COMPONENTS:

All herbal ingredients including Neem, Aloe vera, Tulsi, and Bamboo leaves were collected from local sources, while Turmeric, Chandan, Liquorice, Honey, Multani mitti, and Rose water were collected from the local market. All materials were authenticated and cleaned prior to use.

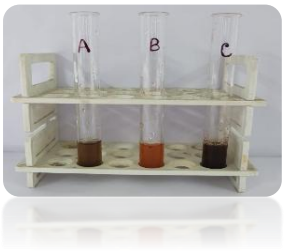
Table 2: Herbal & Chemical Component Details

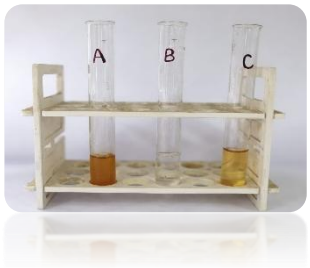
Sr. No.	Ingredients	Chemical Constituents	Functions	Figure
1.	Neem *(Azadirachta indica)* Family: Meliaceae Plant part: leaf	Nimbidol, azadirachtin ($C_{35}H_{44}O_{16}$)	Antibacterial property, treats acne, and protects the skin from external aggregates.[11]	
2.	Turmeric *(Curcuma longa)* Family: Zingiberaceae Plant part: Root and rhizomes	Curcumin($C_{21}H_{20}O_6$), Zingiberene ($C_{15}H_{24}$)	Anti-inflammatory agent, reduce scarring, lightening anti-wrinkle, wound healing.[12]	
3.	Aloe vera *(Aloe barbadensis miller)* Family: Asphodelaceae Plant part: leaf	Aloin($C_{21}H_{22}O_9$), aloe emodin	Antibacterial and anti-inflammatory properties, cooling effect on rashes and sunburns.[13]	
4.	Bamboo (*Bambusa vulgaris*) Family: Poaceae Plant part: leaf	Orientin($C_{21}H_{20}O_{11}$), Vitexin ($C_{21}H_{20}O_{10}$)	Containing antioxidant, it contains flavonoids such as Orientin and Vitexin, which protect the skin from free radical damage. This helps in preventing premature aging and maintaining healthy skin.[14]	
5.	Tulsi *(Ocimum tenuiflorum)* Family: Lamiaceae Plant part: leaf	Eugenol($C_{10}H_{12}O_2$), Estragole($C_{10}H_{12}O$)	Antifungal, anti-inflammatory, antibacterial properties facilitate to purify blood and remove toxins, prevents appearance of acne and pimples.[15]	

7.	Liquorice *(Glycyrrhiza glabra)* Family: Leguminosae Plant part: Root	Glycyrrhizin, Isoliquiritin	Have a soothing effect, and ease inflammation.[17]	
8.	Honey *(Apis mellifera)* Family: Apidae	Glucose($C_6H_{12}O_6$), Fructose($C_6H_{12}O_6$)	Containing anti-bacterial, anti-inflammatory and humectant properties, prevent acne and inflammation.[18]	
9.	Rose water *(Rosa damascena)* Family: Rosaceae Plant part: Rose petals	Geraniol($C_{10}H_{18}O$), Citronellol ($C_{10}H_{20}O$)	Removes excess oil and impurities, reduce black heads, acne scars and black spots.[19]	
10.	Multani mitti *(Bentonite clay)*	Hydrated aluminium silicates, Magnesium chloride	It is a natural cleanser, acne-fighter, sebum controller and skin rejuvenating agent.[20]	
6.	Chandan *(Santalum album)* Family: Santalaceae Plant part: Wood powder	Alpha-Santalol, Beta-Santalol	Helps to nourish the skin, improve the elasticity of skin cells, reduce scars, anti-tanning and anti-aging property, pimple and acne treatment.[16]	

2.EXTRACTION OF DIFFERENT HERBAL DRUGS:

3. SCREENING OF THOSE EXTRACTED COMPONENTS:

Sr.no.	Ingredients	Reactions	Observation	Experimental Record
1.	Neem	0.5g of the extract was added in HCL. After dissolving it was filtered using filter paper and 2 ml of the filtrated was treated with Dragendorff's reagent (a solution of potassium bismuth iodide).	Formation of a reddish precipitate confirmed the presence of alkaloids. A= Plant extract B= reagent C= Observed result	
2.	Turmeric	1 or 2 ml of extract was added with Wagner's reagent (dissolving 2 gm of iodine and 6 gm of potassium iodide in 100 ml of distilled water).	Reddish brown precipitate shows the presence of alkaloids. A= Plant extract B= reagent C= Observed result	
3.	Aloe vera	2 ml of acetic anhydride + 2 ml of H_2SO_4 were added to 5 ml of extract	Colour was changed from blue to violet and indicated the presence of steroids. A= Plant extract B= reagent C= Observed result	
4.	Bamboo	Add 1-2 drops of 5% $FeCl_3$ solution to aqueous extract	Blue-black or dark green colour shows the presence of tannins. A= Plant extract B= reagent C= Observed result	
5.	Tulsi	5mg extract added with 0.5 ml of ferric chloride solution	Formation of blackish precipitate shows the presence of tannins. A= Plant extract B= reagent C= Observed result	

6.	Liquorice	80% H_2SO_4 treated with powder of the drug.	Orange yellow is observed for transformation of flavone glycoside liquiritigenin to chalcone glycoside isoliquiritin. A= Plant extract B= reagent C= Observed result	
7.	Honey	Few drops of honey put into a solution of vinegar-water.	The mixture is not foaming and shows that the honey is real. A= Plant extract B= reagent C= Observed result	

4. FORMULATION STUDY:

The herbal powder was formulated using natural ingredients with skin-beneficial properties. Neem and Tulsi were added for antimicrobial activity. Turmeric and Liquorice were included for anti-inflammatory and skin-brightening effects. Aloe vera and Honey were incorporated for moisturizing and soothing action. Chandan provided cooling and fragrance, while Bamboo extract contributed mild exfoliating properties. Multani mitti was used as the base due to its oil-absorbing and cleansing properties, and Rose water was added for toning and pleasant aroma. All ingredients were accurately weighed, sieved, and blended uniformly to obtain a homogeneous powder. The final product was stored in an airtight container to prevent moisture absorption and contamination.

Table 3: Formulation table for herbal powder

Sr. no.	Ingredients	Each 10gm contain
1.	Neem extract	0.6 %
2.	Turmeric extract	1.0 %
3.	Aloe -vera extract	0.8 %
4.	Bamboo extract	1.0 %
5.	Tulsi extract	0.5 %
6.	Chandan	0.6 %
7.	Liquorice extract	0.5%
8.	Honey	0.5%
9.	Rose water	0.5%
10.	Multani mitti	4.0%

EVALUATION:

A. ORGANOLEPTIC PROPERTIES: appearance, colour, odour, texture, smoothness was observed as presented in Table 4.

Table 4: Organoleptic properties of herbal formulation

Sl. No.	Organoleptic Properties	Observation
1.	Appearance	Fine powder
2.	Colour	Pale Yellow
3.	Odour	Characteristic
4.	Texture	Fine, Smooth
5.	Smoothness	Smooth

B. PHYSICOCHEMICAL PROPERTIES: pH, ash value, loss on drying, were calculated and the obtained values are presented in Table 5.

Table 5: Physicochemical Properties of herbal formulation

Sl. No.	Physicochemical Properties	Observation
1.	Total Ash Value	8.0 %
2.	pH	7.4
3.	LOD	7.0%

C. GENERAL PROPERTIES: Particle size was determined using microscopic analysis. Additionally, the bulk density, tapped density, and angle of repose of the dried powder blend were evaluated using the tapping method to determine its flow characteristics, as presented in Table 6.

Table 6: General Powder Characteristics of herbal formulation

Sl. No.	General Powder Properties	Observation
1.	Angle of repose	19.79^0
2.	Bulk density	0.40 g/ml
3.	Tapped density	0.50 g/ml
4.	Hausner's ratio	1.25
5.	Carr's Index	20 %
6.	Washability	Easily Washable
7.	Skin irritability test	No

RESULTS AND DISCUSSION

The prepared herbal powder was evaluated for different parameters to determine its quality, stability and suitability for skin application.

The organoleptic properties showed that the formulation was a fine, smooth powder with a pale-yellow colour and characteristic odour, indicating good acceptability.

The physicochemical properties showed that the pH of the formulation was 7.4 which is suitable for skin application. The ash value was found to be 8 %, indicating the presence of inorganic constituents, and the loss of drying was 7%, suggesting low moisture content and good stability.

The flow properties of the powder were found satisfactory. The angle of repose (19.79 degrees), bulk density (0.40 g/ml), and tapped density (0.50 g/ml) indicated good flow characteristics. The Hausner's ratio (1.25) and Carr's Index (20%) further confirmed acceptable flow properties.

The formulation was easily washable and showed no signs of skin irritation during the study period, indicating its safety for topical use.

A short-term stability study was carried out for a period of one month. During this period, no significant changes were observed in colour, odour, texture, or pH of the formulation. The powder remained stable without any signs of microbial growth, confirming its stability under normal storage conditions.

CONCLUSION

The present study successfully developed and evaluated a plant-based herbal powder formulation using selected medicinal ingredients with dermatological benefits. The formulation demonstrated satisfactory organoleptic and physicochemical properties, along with a skin-compatible pH and low moisture content. The presence of bioactive compounds such as flavonoids, tannins, and phenolic constituents contributes to its antimicrobial, anti-inflammatory, and skin-soothing properties. The formulation was found to be stable, easily washable, and non-irritant upon topical application. Therefore, the

developed herbal powder can be considered a promising natural alternative for skincare applications. However, further long-term stability studies and clinical trials are required to confirm its efficacy and support commercial utilization. In this study, the formulation showed good potential for use as a natural skincare product.

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CONFLICT OF INTEREST: None

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