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Research Article

Development and Evaluation of an Herbal Hair Removal Powder Formulated with Selected Natural Ingredients

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ABSTRACT

Background: Herbal depilatory formulations have attracted considerable attention as safer alternatives to conventional chemical hair removal products due to their reduced risk of skin irritation and additional skin-beneficial properties. The use of plant-derived ingredients with depilatory, anti-inflammatory, and antimicrobial activities offers a promising approach for developing effective and skin-friendly cosmetic preparations. **Objectives:** The present study aimed to formulate and evaluate an herbal hair removal powder using selected natural ingredients and to assess its physicochemical characteristics, stability, skin compatibility, and hair removal efficiency. **Materials and Methods:** Three formulations (F1, F2, and F3) were prepared using *Carica papaya* (papaya), Ponnantharam powder, *Curcuma longa* (turmeric), *Azadirachta indica* (neem), *Acalypha indica* (Harita Manjari), and Multani Mitti. The formulations were evaluated for organoleptic characteristics, ash value, moisture content, pH, spreadability, rheological properties (angle of repose, bulk density, tapped density, Hausner's ratio, and Carr's index), stability under room temperature conditions, skin irritation, and hair removal efficiency. **Results:** All formulations exhibited satisfactory physicochemical characteristics with acceptable colour, odour, texture, moisture content, and pH suitable for topical application. The powder formulations demonstrated good flow properties, satisfactory spreadability, and remained stable throughout the storage period without noticeable changes in colour, odour, or texture. No signs of skin irritation, redness, or swelling were observed during the skin compatibility study. Among the developed formulations, F3 demonstrated superior spreadability, improved flow characteristics, and better overall hair removal performance compared with F1 and F2. **Conclusion:** The developed herbal hair removal powder demonstrated satisfactory physicochemical properties, stability, skin compatibility, and effective hair removal performance. The formulation may serve as a promising natural alternative to conventional chemical depilatory products. Further studies involving advanced stability evaluation, safety assessment, and clinical investigations are recommended to establish its long-term efficacy and commercial applicability.

Keywords: *Acalypha indica*, *Azadirachta indica*, *Carica papaya*, Multani mitti, Ponnantharam powder.

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INTRODUCTION

Unwanted body hair removal is an important component of personal hygiene and cosmetic care (World Health Organization, 2007). Throughout history, various methods have been employed to remove unwanted hair, including shaving, threading, waxing, plucking, chemical depilatories, laser therapy, and electrolysis (Barel *et al*., 2014). Each method possesses distinct advantages and limitations with respect to efficacy, cost, duration of action, convenience, and safety. Mechanical methods such as shaving and waxing provide temporary results but may be associated with skin irritation, folliculitis, ingrown hair, cuts, and discomfort. Although laser therapy and electrolysis offer long-term hair reduction, their high cost and requirement for specialized equipment limit their widespread use (Harry, 2000; Verma *et al*., 2011). Consequently, there is increasing interest in developing safe, economical, and effective herbal alternatives for routine hair removal (Traversa *et al*., 2007). Conventional depilatory creams and powders commonly contain chemicals such as calcium thioglycolate, potassium thioglycolate, and alkaline agents that weaken the keratin structure of hair, thereby facilitating hair removal. Despite their effectiveness, these formulations are frequently associated with adverse effects including skin irritation, erythema, allergic reactions, unpleasant odour, dryness, and disruption of the skin barrier, particularly in individuals with sensitive skin. Increasing consumer awareness regarding the potential side effects of

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synthetic cosmetic products has accelerated the demand for herbal formulations prepared from naturally derived ingredients (Barel *et al.*, 2014; Harry, 2000; Traversa *et al.*, 2007; Verma *et al.*, 2011).

Herbal cosmetics have gained considerable popularity because they combine cosmetic efficacy with the therapeutic benefits of medicinal plants (World Health Organization, 2011). Herbal formulations generally contain phytoconstituents possessing anti-inflammatory, antimicrobial, antioxidant, wound-healing, and skin-conditioning properties, which contribute to improved skin health while minimizing adverse reactions (Khandelwal, 2021). These products are considered environmentally friendly, biodegradable, and more acceptable to consumers seeking natural personal care products (Kokate *et al.*, 2021).

The present formulation was developed using carefully selected herbal ingredients with well-documented cosmetic and pharmacological properties. *Carica papaya* contains papain, a proteolytic enzyme capable of hydrolysing keratin proteins and weakening the hair shaft, thereby facilitating hair removal (Aravind *et al.*, 2013; Kumar *et al.*, 2011). *Curcuma longa* (turmeric) possesses anti-inflammatory, antioxidant, and antimicrobial activities that help protect the skin from irritation following depilation (Hewlings and Kalman, 2017). *Azadirachta indica* (neem) exhibits potent antimicrobial and anti-inflammatory properties and contributes to maintaining skin hygiene and reducing the risk of infection (Baby *et al.*, 2022; Subapriya and Nagini, 2005). *Acalypha indica* (Harita Manjari) has traditionally been used in herbal medicine for cosmetic applications (Bhat and Al-Daihan, 2014). Multani Mitti acts as a natural absorbent and cleansing agent that enhances the texture and spreadability of the formulation. Ponnantharam, a traditional ingredient used in certain herbal depilatory preparations, contributes to the overall depilatory action when incorporated in appropriate proportions (Ayyanar and Ignacimuthu, 2005; Pandey *et al.*, 2013).

In recent years, considerable research has focused on developing herbal depilatory formulations that are effective, safe, and cosmetically acceptable. The incorporation of herbal ingredients not only assists in hair removal but also provides additional benefits such as skin nourishment, soothing effects, antioxidant protection, and improved skin texture. These advantages make herbal depilatory products attractive alternatives to conventional chemical preparations.

Therefore, the present study was undertaken to develop and evaluate an herbal hair removal powder formulated using selected natural ingredients. The prepared formulations were evaluated for their organoleptic characteristics, physicochemical properties, rheological behaviour, stability, skin compatibility, and hair removal efficiency in order to determine their suitability as a safe and effective herbal depilatory preparation. The findings of this study may contribute to the development of affordable, natural, and skin-friendly cosmetic products with potential applications in the herbal cosmetics industry (Prajapati *et al.*, 2023; Shanker *et al.*, 2021; Verma *et al.*, 2011).

MATERIALS AND METHODS

Materials

Fresh unripe papaya (*Carica papaya* L.), turmeric rhizomes (*Curcuma longa* L.), neem leaves (*Azadirachta indica* A. Juss.), Harita Manjari (*Acalypha indica* L.), Multani Mitti (*Solum fullonum*), and Ponnantharam powder were used for the preparation of the herbal hair removal powder. All herbal materials were procured from authenticated local sources and were of pharmaceutical grade. Methanol, ethanol, and other analytical-grade chemicals and reagents used during the study were obtained from standard laboratory suppliers.

Authentication of Herbal Materials

The herbal materials used in the present study, including *Carica papaya* L., *Curcuma longa* L., *Azadirachta indica* A. Juss., and *Acalypha indica* L., were procured from a local herbal supplier in Maharashtra, India. The plant materials were identified based on their macroscopic and morphological characteristics with the help of standard pharmacognostic literature before their use in the formulation (Table 1). All materials were cleaned, shade-dried, and processed under laboratory conditions prior to formulation (Khandelwal, 2021; Kokate *et al.*, 2021; Prajapati *et al.*, 2023; World Health Organization, 2011).

Extraction of Herbal Materials

Extraction of Neem Leaves

Fresh neem leaves were washed thoroughly with distilled water to remove dust and other impurities and then shade-dried at room temperature. The dried leaves were coarsely powdered. Approximately 10 g of powdered leaves were extracted with 100 mL of methanol by heating at 60°C for 1 hr with intermittent stirring. The extract was filtered using Whatman No. 1 filter paper and stored in an airtight container until further use.

Extraction of Papain from *Carica papaya*

Fresh, unripe papaya fruits were selected for papain extraction. Superficial incisions were made on the fruit surface to collect the milky latex. The collected latex was dried under controlled conditions to obtain crude papain powder. The dried material was dissolved in distilled water, filtered to remove insoluble impurities, precipitated using ethanol (50-70%), dried, and stored in an airtight container until formulation.

Preparation of Turmeric Extract

Cleaned and shade-dried rhizomes of *Curcuma longa* were pulverized into coarse powder. The powder was extracted by maceration using 70-95% ethanol for 48 hr with occasional

stirring. The extract was filtered and concentrated under reduced pressure to obtain a semisolid extract suitable for formulation.

Preparation of Ponnantharam Powder

Ponnantharam powder was finely powdered and passed through sieve No. 80 to obtain a uniform particle size. The powdered material was stored in airtight containers under dry conditions until further use (Shanker *et al.*, 2021; Verma *et al.*, 2011).

Formulation of Herbal Hair Removal Powder

Three formulations (F1, F2, and F3) were prepared by varying the concentration of active ingredients while maintaining uniform mixing procedures. The composition of each formulation is presented in Table 2.

Preparation of Herbal Hair Removal Powder

All powdered ingredients were accurately weighed using a calibrated digital balance. Each ingredient was individually passed through sieve No. 80 to ensure uniform particle size. The weighed ingredients were blended thoroughly in a clean mortar until a homogeneous powder mixture was obtained. The prepared formulations were transferred into airtight containers and stored at room temperature in a cool, dry place until further evaluation (Barel *et al.*, 2014; Harry, 2000; Shanker *et al.*, 2021; Verma *et al.*, 2011) (Figure 1).

Mechanism of Action

The herbal hair removal powder was mixed with an appropriate quantity of water or rose water to prepare a smooth paste before application. Upon application, proteolytic constituents, particularly papain, interact with keratin proteins present in the hair shaft, resulting in weakening of the hair structure. As the paste dries, it forms an adhesive film that entraps the loosened hair. Gentle rubbing or peeling of the dried film facilitates mechanical removal of the weakened hair while herbal ingredients such as turmeric and neem provide anti-inflammatory, antimicrobial, and skin-soothing effects.

Evaluation of Herbal Hair Removal Powder

The prepared formulations were evaluated using the following parameters:

Organoleptic Evaluation

Colour, odour, texture, and overall appearance of each formulation were examined visually (Khandelwal, 2021; Kokate *et al.*, 2021).

Physicochemical Evaluation

The formulations were evaluated for total ash value, moisture content, pH, and spreadability using standard pharmacopeial procedures (Khandelwal, 2021; Kokate *et al.*, 2021; Prajapati *et al.*, 2023; World Health Organization, 2011).

Rheological Evaluation

Flow characteristics were assessed by determining the angle of repose, bulk density, tapped density, Hausner's ratio, and Carr's compressibility index (Aulton and Taylor, 2018; Indian Pharmacopoeia Commission, 2022; Lachman *et al.*, 1987; United States Pharmacopeial Convention, 2020).

Stability Study

The formulations were stored at room temperature for one month and periodically evaluated for changes in colour, odour, texture, and pH (Aulton and Taylor, 2018; Banker and Rhodes, 2002; United States Pharmacopeial Convention, 2020).

Skin Irritation Test

A small quantity of the prepared paste was applied to the skin and observed for redness, swelling, irritation, or any visible adverse reaction after the specified observation period (Ali and Yosipovitch, 2013; Baby *et al.*, 2022; Barel *et al.*, 2014).

Hair Removal Efficiency Test

The hair removal efficiency of the prepared herbal hair removal powder formulations was evaluated by visual observation following topical application. A sufficient quantity of each formulation was mixed with water to obtain a smooth, homogeneous paste and applied uniformly to the test area. After allowing the paste to dry (approximately 15-20 min), it was gently removed in the direction opposite to hair growth (Figure 3).

The formulations were evaluated based on the following predefined criteria

Ease of application, Uniformity of spreading on the skin, Drying time, Ease of hair removal, Extent of hair removal (residual hair remaining after application), Skin smoothness after hair removal, Presence or absence of skin irritation, redness, burning sensation, or itching, overall cosmetic acceptability.

Table 1: API and Excipient used in hair removal powder.

API	Purpose
Papaya (*Carica papaya* L.)	Natural growth inhibitor
Harita Manjari (*Acalypha indica* L.)	Get rid of unwanted hair
Ponnantharam (*Arsenic trisulfide*)	Exfoliation and skin brightening
Multani Mitti (*Solum fullonum*)	Exfoliation and cleansing
Neem (*Azadirachta indica* A.)	Reduces skin irritation, prevents infection
Turmeric (*Curcuma longa* L.)	Antibacterial, Anti-inflammatory

Based on these observations, the formulations were comparatively graded as 1, 2, 3, 4, 5 according to their overall performance (Figure 2).

Hair Removal Efficiency Scoring System

The hair removal efficiency of the developed herbal hair removal powder formulations was evaluated using a semi-quantitative scoring system based on visual observation following topical application. The formulations were assessed for ease of application, uniformity of spreading, drying time, hair removal efficiency, residual hair after application, skin smoothness, skin irritation, and overall cosmetic acceptability. Each parameter was assigned a score ranging from 1 to 5, where a higher score indicated better performance (Table 3) (Barel *et al.*, 2014; Harry, 2000; Shanker *et al.*, 2021; Traversa *et al.*, 2007; Verma *et al.*, 2011).

Statistical Analysis

The experimental observations obtained during the evaluation of the herbal hair removal powder formulations were recorded and compared descriptively. The physicochemical characteristics, rheological properties, stability, skin irritation, and hair removal efficiency of the formulations were evaluated using standard pharmaceutical evaluation methods. As the present investigation was conducted as a preliminary formulation and evaluation study, the results are presented descriptively without inferential statistical analysis.

RESULTS AND DISCUSSION

Organoleptic Evaluation

The organoleptic characteristics of the prepared herbal hair removal powder formulations (F1, F2, and F3) were evaluated for colour, odour, and texture. The observations are presented in Table 4.

The organoleptic evaluation demonstrated that all three formulations possessed acceptable physical characteristics suitable for topical cosmetic application. Variation in colour among the formulations was attributed to differences in the concentration of herbal ingredients, particularly papaya, turmeric, and Ponnantharam powder. All formulations exhibited a characteristic herbal odour without any objectionable smell, indicating the absence of deterioration during preparation. The smooth texture obtained in each formulation suggests adequate blending and uniform distribution of ingredients, which is expected to facilitate easy mixing with water or rose water before application. These observations indicate that the prepared formulations possessed satisfactory aesthetic and handling properties desirable for herbal cosmetic products.

Physicochemical Evaluation

The physicochemical properties of the prepared herbal hair removal powder formulations were evaluated to determine their quality, stability, and suitability for topical application. The evaluated parameters included total ash value, moisture content, pH, and spreadability. The results are summarized in Table 5.

The total ash value of all formulations ranged from 5.80% to 5.83%, indicating minimal variation in inorganic matter among the prepared formulations. The comparable ash values suggest uniform incorporation of herbal ingredients and the absence of excessive inorganic impurities, thereby reflecting acceptable quality of the powdered formulations.

Moisture content remained constant (4.20%) across all formulations, demonstrating adequate drying and low residual moisture. Low moisture content is an important quality parameter for herbal powder formulations, as it minimizes the possibility of microbial growth, prevents clumping during storage, and enhances product stability and shelf life.

The pH values of the formulations ranged from 6.4 to 6.5, which is close to the normal physiological pH of human skin. This indicates that the developed formulations are suitable for topical application and are less likely to produce skin irritation or discomfort during use. Maintenance of skin-compatible pH is an essential requirement for cosmetic formulations intended for repeated application.

Spreadability increased progressively from F1 (6.35 cm^2) to F3 (11.30 cm^2), indicating improved ease of application with increasing concentration of the formulation components. Higher spreadability facilitates uniform distribution of the prepared paste over the skin surface, resulting in better contact between the active ingredients and hair follicles. Among the developed formulations, F3 exhibited the highest spreadability, suggesting superior application characteristics and improved user convenience.

Overall, the physicochemical evaluation demonstrated that all three formulations possessed acceptable quality characteristics. However, F3 exhibited comparatively superior physicochemical performance, particularly with respect to spreadability, indicating its greater suitability as a herbal hair removal powder.

Rheological Evaluation

The rheological properties of the prepared herbal hair removal powder formulations were evaluated to determine their flow behaviour, compressibility, and suitability for handling during manufacturing and application. The evaluated parameters included angle of repose, bulk density, tapped density, Hausner's ratio, and Carr's compressibility index. The results are presented in Table 6.

The angle of repose is an important indicator of powder flowability. The values obtained ranged from 33.5° to 36.8°, indicating acceptable flow characteristics for all formulations. Among the three formulations, F3 exhibited the lowest angle of

repose (33.5°), suggesting comparatively better flow behaviour and ease of handling during formulation and application.

Bulk density and tapped density provide useful information regarding powder packing characteristics. The observed decrease in both bulk and tapped densities from F1 to F3 indicates improved particle arrangement and reduced interparticle friction, which may facilitate better blending and handling of the powder formulation.

Table 2: Composition of Herbal Hair Removal Powder Formulations.

Ingredient	F1 (g)	F2 (g)	F3 (g)
Carica papaya	9	15	30
Ponnantharam Powder	6	10	20
Azadirachta indica	3	5	10
Acalypha indica	4.5	7.5	15
Curcuma longa	1.5	2.5	5
Multani Mitti	6	10	20

Table 3: Scoring Criteria for Hair Removal Efficiency Evaluation.

Score	Interpretation	Evaluation Criteria
5	Excellent	Complete hair removal with smooth skin, no visible residual hair, excellent skin smoothness, and no signs of irritation, redness, itching, or burning sensation.
4	Very Good	Nearly complete hair removal with minimal residual hair, good skin smoothness, and no significant irritation or discomfort.
3	Good	Satisfactory hair removal with slight residual hair, acceptable skin smoothness, and good skin compatibility without noticeable adverse effects.
2	Fair	Partial hair removal with moderate residual hair remaining, average skin smoothness, and mild discomfort or slight skin irritation that resolves spontaneously.
1	Poor	Inadequate hair removal with considerable residual hair, poor skin smoothness, and noticeable irritation, redness, itching, or burning sensation following application.

Table 4: Organoleptic Characteristics of Herbal Hair Removal Powder Formulations.

Parameter	F1	F2	F3
Colour	Light Brown	Yellowish Brown	Ochre
Odour	Characteristic	Characteristic	Characteristic
Texture	Smooth	Smooth	Smooth

Table 5: Physicochemical Properties of Herbal Hair Removal Powder Formulations.

Parameter	F1	F2	F3
Total Ash Value (%)	5.83	5.80	5.80
Moisture Content (%)	4.20	4.20	4.20
pH	6.5	6.4	6.5
Spreadability (cm^2)	6.35	9.49	11.30

Table 6: Rheological Properties of Herbal Hair Removal Powder Formulations.

Parameter	F1	F2	F3
Angle of Repose (°)	36.8	35.4	33.5
Bulk Density (g/mL)	0.34	0.28	0.26
Tapped Density (g/mL)	0.41	0.33	0.31
Hausner's Ratio	1.35	1.28	1.22
Carr's Compressibility Index (%)	18.28	13.55	11.98

Table 7: Stability Evaluation of Herbal Hair Removal Powder Formulations.

Parameter	F1	F2	F3
Colour	No significant change	No significant change	No significant change
Odour	No significant change	No significant change	No significant change
Texture	No significant change	No significant change	No significant change
pH	No significant change	No significant change	No significant change

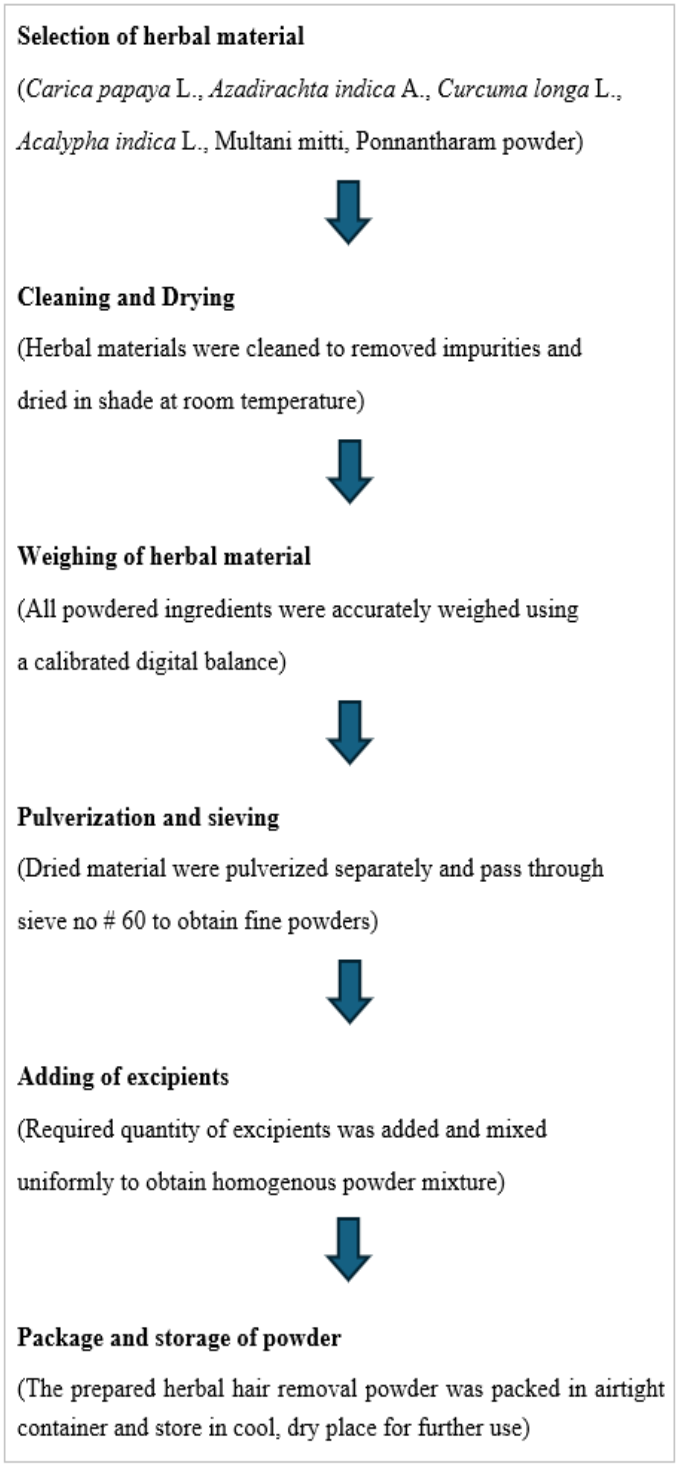

Figure 1: Method of preparation of herbal hair removal powder.

Hausner's ratio is widely used to assess powder flowability, where values below 1.25 generally indicate good flow properties. The Hausner's ratio values obtained for F1, F2, and F3 were 1.35, 1.28, and 1.22, respectively. The comparatively lower value observed for F3 indicates superior flow characteristics compared with the other formulations.

Carr's compressibility index is another important parameter used to evaluate powder compressibility and flow behaviour. Lower Carr's index values represent better flowability. In the present study, Carr's compressibility index decreased from 18.28% in F1 to 11.98% in F3, indicating progressive improvement in powder flow properties. The lower compressibility of F3 suggests that the formulation possesses better handling characteristics and is less prone to aggregation during storage.

Overall, the rheological evaluation demonstrated that all formulations exhibited acceptable powder flow properties. However, formulation F3 consistently showed superior rheological performance, as evidenced by its lower angle of repose, lower Hausner's ratio, and lower Carr's compressibility index. These findings indicate that F3 possesses better flowability, compressibility, and overall handling characteristics, making it the most suitable formulation among those developed in the present study.

Stability Study, Skin Irritation Test, and Hair Removal Efficiency

Stability Study

The physical stability of the developed herbal hair removal powder formulations was evaluated under room temperature storage conditions for a period of one month. The formulations were periodically examined for changes in colour, odour, texture, appearance, and pH. The observations are presented in Table 7.

The stability study demonstrated that all formulations remained physically stable throughout the storage period. No noticeable changes were observed in colour, odour, texture, or pH, indicating good compatibility among the incorporated herbal ingredients. The absence of physical deterioration suggests that the formulations possess satisfactory short-term stability under normal storage conditions. These findings indicate that the developed herbal hair removal powder is capable of maintaining its quality and aesthetic characteristics during storage.

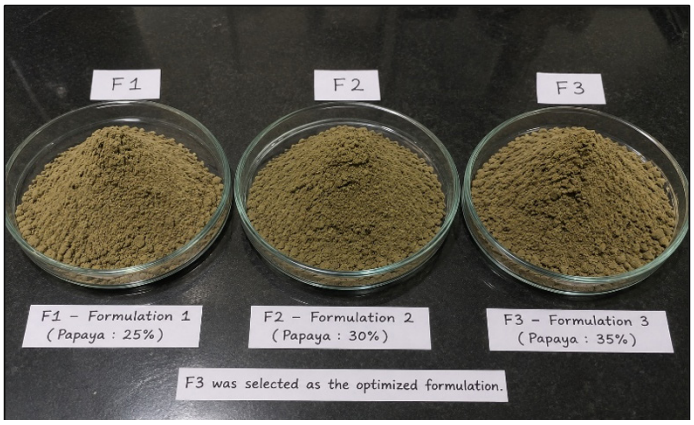

Figure 2: Batch optimization of formulation (F1-F3).

Table 8: Skin Irritation Study.

Observation	Result
Redness	Absent
Swelling	Absent
Itching	Absent
Burning Sensation	Absent
Allergic Reaction	Not observed

Hair Removal Efficiency Test

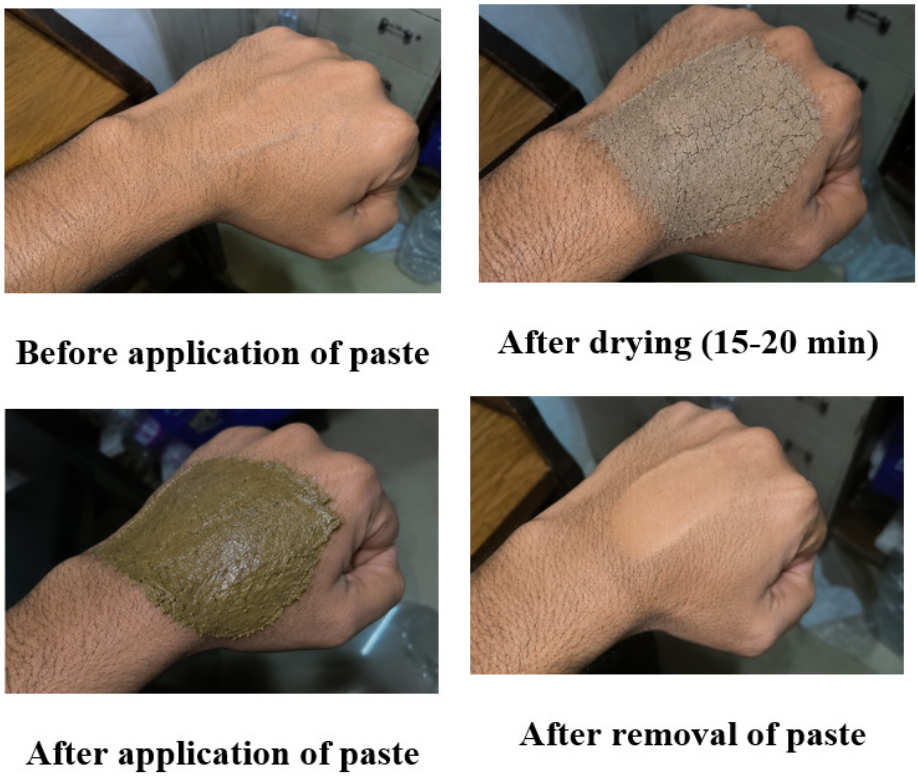

Figure 3: Effect of paste on skin before and after application.

Skin Irritation Test

The developed formulations were evaluated for their potential to produce skin irritation following topical application. The treated skin area was carefully observed for signs of erythema, itching, burning sensation, swelling, or any other visible adverse reaction. The observations are summarized in Table 8.

No visible signs of skin irritation or hypersensitivity were observed following application of the herbal hair removal powder. The absence of redness, swelling, itching, and burning sensation suggests that the developed formulations were well tolerated under the study conditions. The presence of herbal ingredients with anti-inflammatory properties, particularly *Curcuma longa* and *Azadirachta indica*, may have contributed to improved skin compatibility and reduced irritation potential. These observations indicate that the developed formulation is suitable for topical cosmetic application, although further dermatological and clinical studies are recommended to confirm long-term safety.

Table 9: Hair Removal Efficiency Evaluation of Herbal Hair Removal Powder.

Evaluation Parameter	F1	F2	F3
Ease of Application	3	4	5
Uniformity of Application	3	4	5
Drying Time	3	4	5
Hair Removal Efficiency	3	4	5
Residual Hair after Application*	3	4	5
Skin Smoothness	3	4	5
Skin Irritation**	5	5	5
Overall Cosmetic Acceptability	3	4	5

* Higher scores indicate less residual hair after application. ** A score of 5 indicates no skin irritation, whereas lower scores indicate increasing irritation.

CONCLUSION

The present study successfully developed and evaluated an herbal hair removal powder formulated using selected natural ingredients, including *Carica papaya* L., *Curcuma longa* L., *Azadirachta indica* A. Juss., *Acalypha indica* L., Ponnantharam powder, and Multani Mitti. The developed formulations exhibited satisfactory organoleptic characteristics, acceptable physicochemical properties, good rheological behaviour, adequate short-term stability, and favourable skin compatibility.

Among the three formulations, demonstrated superior performance with respect to spreadability, powder flow properties, ease of application, hair removal efficiency, and overall cosmetic acceptability. The formulation effectively removed unwanted hair without producing visible signs of skin irritation, redness, or discomfort under the study conditions. The incorporation of herbal ingredients possessing proteolytic, anti-inflammatory, antimicrobial, and skin-conditioning properties contributed to the overall effectiveness and cosmetic acceptability of the formulation.

The findings of the present investigation suggest that the developed herbal hair removal powder has potential as a natural alternative to conventional chemical depilatory products. However, this investigation represents a preliminary formulation and evaluation study. Further studies involving long-term stability testing, microbiological quality assessment, heavy metal analysis, dermatological safety evaluation, larger volunteer-based clinical studies, and statistical validation are recommended to establish the formulation's long-term safety, efficacy, and commercial applicability.

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ABBREVIATIONS

API: Active Pharmaceutical Ingredient; **L:** Linnaeus; **F1, F2, and F3:** Designations for the three different concentrations of the herbal formulations; **g:** Grams; **mL:** Milliliters; **ºC:** Degrees Celsius; **No.:** Number; **pH:** Potential of hydrogen; **%:** Percent; **cm²:** Square centimeters; **g/mL:** Grams per milliliter; **min:** Minutes; **WHO:** World Health Organization; **USP:** United States Pharmacopeia; **IP:** Indian Pharmacopoeia.

CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

AUTHOR CONTRIBUTIONS

Vikas D. Kedar: Conceptualization, Methodology, Supervision, Project Administration. **Rushikesh K. Kokane:** Investigation, Experimental Work, Data Acquisition. **Rushikesh M. Korgaonkar:** Investigation, Data Collection, Laboratory Analysis. **Mrunal R. Kurle:** Literature Review, Resource Collection, Data Compilation. **Tanishka M. Koli:** Data Analysis. **Ritesh G. Kodre:** Statistical Description. **Rahul N. Patil:** Manuscript Preparation, Writing - Original Draft, Writing - Review & Editing. All authors have read and approved the final version of the manuscript and agree to be accountable for all aspects of the work.

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