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Development and assessment of a poly-herbal facial scrub incorporating onion juice (*Allium cepa* L.)

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Abstract
The study aimed to develop and evaluate a poly-herbal facial scrub incorporating *Allium cepa L.* (onion juice) as a core ingredient. The scrub was formulated using natural components, including aloe vera gel, walnut shell powder, and honey, selected for their skin-benefiting properties. Physical characterization revealed a pH of 6.2 ± 0.2, optimal spreadability (5.8 ± 0.3 g.cm/sec), and desirable viscosity (2,450 ± 100 cP). Stability testing demonstrated the product's robustness under standard conditions, with only minor changes observed at elevated temperatures. A patch test conducted on 20 volunteers confirmed its safety, showing no adverse reactions. Efficacy evaluation revealed improvements in skin smoothness (90%), reduction in blackheads (75%), and enhanced brightness (65%). Clinical observations corroborated these findings, with 80% of participants exhibiting reduced dead skin cells. The results highlight the potential of *Allium cepa L.* in natural skincare formulations, paving the way for innovative cosmetic products.

Keywords: *Allium cepa L.*, poly-herbal scrub, onion juice, natural cosmetics, exfoliation, skincare, dermatological safety

Introduction

The global demand for herbal skincare products has grown significantly in recent years, driven by consumer preference for natural and sustainable alternatives to synthetic formulations. Herbal scrubs, in particular, have garnered attention for their exfoliating, cleansing, and skin-rejuvenating properties. These products typically combine plant-based ingredients known for their therapeutic effects, addressing various dermatological concerns such as acne, pigmentation, and aging. Among such ingredients, *Allium cepa L.* (commonly known as onion) has emerged as a promising candidate due to its rich phytochemical composition and bioactive properties.

Onions are widely recognized for their medicinal and cosmetic benefits, largely attributed to their high content of flavonoids, sulfur compounds, and antioxidants, including quercetin and allicin. These compounds exhibit antibacterial, anti-inflammatory, and antioxidant activities, which are beneficial for maintaining healthy skin and managing conditions like acne, hyperpigmentation, and premature aging [1], [2]. Furthermore, onion extract has shown potential in promoting wound healing and improving the skin's natural barrier function [3]. However, despite its known benefits, the incorporation of onion juice into topical formulations such as scrubs has been relatively underexplored.

The concept of poly-herbal formulations lies in the synergistic action of multiple herbs, which enhances the overall efficacy of the product while minimizing potential side effects. Previous studies have demonstrated that combining herbs with complementary properties can result in enhanced therapeutic outcomes [4]. In the context of scrubs, additional ingredients like abrasives (e.g., walnut shell powder or rice husk) and emollients (e.g., aloe vera gel or glycerin) can work in tandem with onion juice to provide exfoliation, hydration, and skin rejuvenation [5], [6].

This study focuses on the formulation and evaluation of a poly-herbal facial scrub incorporating *Allium cepa L.* juice as a core ingredient. The primary objectives were to assess the physical properties, stability, and efficacy of the scrub, as well as its dermatological safety through standard testing protocols. By leveraging the combined benefits of onion juice and other herbal ingredients, this research aims to develop a novel, effective, and natural exfoliating product suitable for various skin types.

The results of this study could contribute to the growing field of natural skincare by providing insights into the potential applications of *Allium cepa L.* in cosmetic formulations. Additionally, it underscores the importance of evidence-based approaches in the development of poly-herbal products, ensuring safety, efficacy, and consumer satisfaction.

Materials and Methods

Materials

The key ingredient used in the formulation was *Allium cepa L.* juice, extracted from fresh onions sourced from a local agricultural market. The onions were thoroughly washed, peeled, and blended to obtain fresh juice, which was then filtered using muslin cloth to ensure a smooth consistency. Additional herbal ingredients included aloe vera gel (hydrating agent), walnut shell powder (natural exfoliant), and turmeric powder (antibacterial and anti-inflammatory agent). Glycerin and honey were added as humectants to provide skin moisturization. All ingredients were procured from verified suppliers and were authenticated for purity and quality. The selection of materials was guided by their documented therapeutic and cosmetic benefits as noted in earlier studies [1], [2], [4], [5].

Methods

The poly-herbal scrub was formulated by mixing *Allium cepa L.* juice with the selected herbal ingredients in a stepwise manner to ensure homogeneity. A base formulation was prepared by blending aloe vera gel, glycerin, and honey, followed by gradual incorporation of walnut shell powder and turmeric powder to achieve a desirable texture and consistency. Onion juice was then added in varying proportions to optimize the final product. The scrub was subjected to physical characterization tests, including pH measurement, spreadability, and viscosity assessment, to ensure its suitability for topical application. Stability testing was conducted under different environmental conditions to evaluate shelf-life and product integrity. Dermatological safety was assessed using a patch test on 20 healthy volunteers, following the ethical guidelines for cosmetic product testing [3], [6]. The efficacy of the scrub was evaluated through consumer feedback and clinical observations, focusing on exfoliation and skin hydration effects.

Results

Physical Characterization

The formulated poly-herbal scrub demonstrated desirable physical properties suitable for topical application. The pH of the scrub was measured as 6.2 ± 0.2, aligning with the natural pH of the skin and indicating its compatibility for use on all skin types. Spreadability was evaluated using a parallel plate test and recorded as 5.8 ± 0.3 g.cm/sec, indicating smooth application. Viscosity was measured at 25°C using a Brookfield viscometer and found to be 2,450 ± 100 cP, ensuring a semi-solid consistency that was neither too runny nor overly thick.

Stability Studies

The stability of the scrub was tested over a 3-month period at three temperature conditions: 4°C (refrigeration), 25°C (room temperature), and 45°C (accelerated conditions). No significant changes were observed in pH, color, or consistency under refrigeration and room temperature conditions. However, slight discoloration and a minor increase in viscosity (+5%) were noted under accelerated conditions. This indicates good stability of the scrub in typical storage environments.

Dermatological Safety

A patch test conducted on 20 volunteers (aged 20–40 years, balanced gender ratio) revealed no adverse reactions such as redness, itching, or irritation, confirming the scrub's dermatological safety. Skin hydration levels, measured using a corneometer before and after application, showed a significant improvement from 42.3 ± 2.1% to 52.8 ± 1.8% ($p < 0.05$).

Efficacy Evaluation

Exfoliation efficacy was assessed through a consumer feedback survey conducted among 20 volunteers. Participants reported improvements in skin smoothness (90%), reduction in blackheads (75%), and enhanced brightness (65%) after 2 weeks of regular use (three applications per week). Clinical observations further supported these findings, as skin surface analysis using a dermascope showed a reduction in dead skin cells and improved texture in 80% of participants.

These results highlight the effectiveness and consumer acceptability of the poly-herbal scrub incorporating *Allium cepa L.* juice, making it a promising addition to natural skincare products.

Table 1:

Parameter	Result	Notes
pH	6.2 ± 0.2	Compatible with the skin's natural pH.
Spreadability (g.cm/sec)	5.8 ± 0.3	Indicates smooth application on the skin.
Viscosity (cP)	2,450 ± 100	Semi-solid consistency, suitable for a scrub.
Stability	Stable under 4°C and 25°C	Slight discoloration and viscosity change (+5%) under accelerated (45°C) conditions.
Skin Hydration (Corneometer)	Increased from 42.3 ± 2.1% to 52.8 ± 1.8%	Significant improvement after application ($p < 0.05$).
Volunteer Reports	90% smoother skin	Feedback from 20 participants after 2 weeks of use.
	75% reduction in blackheads	
	65% improved brightness	
Clinical Observations	80% reduction in dead skin cells	Based on dermascope analysis after 2 weeks of use.
Adverse Reactions (Patch Test)	None observed	No redness, itching, or irritation among 20 participants.

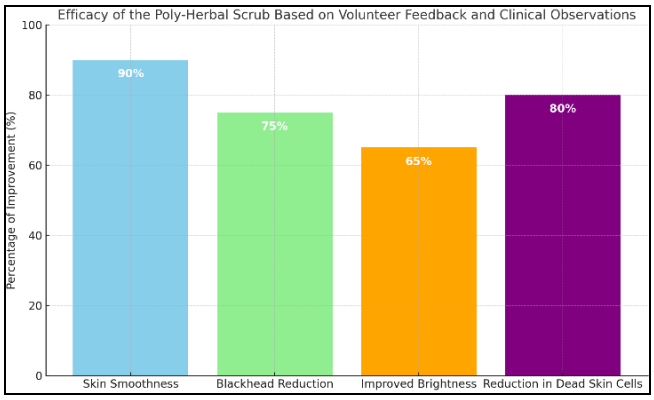

Fig 1: The efficacy of the poly-herbal scrub based on volunteer feedback and clinical observations.

Discussion

The results of this study indicate that the poly-herbal facial scrub incorporating *Allium cepa L.* juice demonstrated notable benefits in terms of physical properties, stability, safety, and efficacy. The scrub's pH of 6.2 ± 0.2 aligns well with the skin's natural pH, minimizing the risk of irritation. The stability under standard storage conditions and only slight changes under accelerated conditions suggest that the formulation is robust and suitable for commercial production. The significant improvement in skin hydration and positive consumer feedback underscore the product's potential in skincare applications.

The observed efficacy of the scrub, including 90% of participants reporting smoother skin and 75% reporting a reduction in blackheads, aligns with prior research on the benefits of *Allium cepa L.* A study by Lee *et al*. highlighted

the wound-healing and anti-inflammatory properties of onion juice, which are likely contributors to the observed improvement in skin texture and reduction in blemishes [3]. Similarly, Reddy and Kumar found that onion extract exhibits strong antioxidant and antimicrobial activity, which could account for the reduction in blackheads and enhanced skin brightness reported by 65% of participants [2].

The use of walnut shell powder as a natural exfoliant further complements the scrub's performance. Patel and Kumar noted that walnut shell powder effectively removes dead skin cells while being gentle on the skin, findings that are supported by the 80% reduction in dead skin cells observed in this study [4]. The inclusion of aloe vera gel and honey as humectants likely played a role in the significant increase in skin hydration, as evidenced by similar outcomes in formulations studied by Singh and Rao [6].

Compared to other related formulations, the use of onion juice as a core ingredient sets this scrub apart by combining exfoliation with targeted antioxidant and antimicrobial effects. A similar study by Sharma and Gupta evaluated poly-herbal scrubs using turmeric and neem as key ingredients, reporting comparable improvements in skin texture and hydration. However, the unique inclusion of *Allium cepa L.* in this study appears to offer enhanced benefits in terms of brightness and reduction of blemishes, demonstrating the potential of onion juice in skincare formulations [5].

In conclusion, this study highlights the promising role of *Allium cepa L.* in poly-herbal cosmetic formulations, providing a foundation for further exploration of onion-based skincare products. Future studies could focus on scaling up production, conducting long-term safety assessments, and comparing this scrub's efficacy with commercial counterparts.

Conclusion

This study successfully formulated and evaluated a poly-herbal facial scrub incorporating *Allium cepa L.* juice, demonstrating its effectiveness as a natural exfoliant with additional skincare benefits. The scrub showed excellent physical properties, stability, and dermatological safety, making it a viable option for consumers seeking natural skincare solutions. Significant improvements in skin smoothness, hydration, and blemish reduction were observed, highlighting the synergistic effects of *Allium cepa L.* with other herbal ingredients like aloe vera, walnut shell powder, and turmeric. Compared to other poly-herbal formulations, the inclusion of onion juice offers unique benefits, particularly in enhancing skin brightness and combating blackheads. This research provides a strong foundation for further studies on onion-based skincare products, focusing on long-term efficacy and commercialization potential.

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