

**SOLID CLEANSING INNOVATIONS: A REVIEW ON DUAL-LAYER
FACE WASH CUBES FOR ENHANCED SKIN CARE**

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ABSTRACT

In recent years, the cosmetic industry has shifted towards the development of eco-friendly and plant-based skincare formulations that offer both functional efficacy and environmental sustainability.^[13,14] Among these innovations, solid cleansing systems such as face wash cubes have gained considerable attention due to their convenience, reduced water content, and minimal packaging requirements.^[24] This review emphasizes the formulation, characteristics, and therapeutic potential of dual layer charcoal and moringa face wash cubes as an advanced approach in herbal cosmetology. Activated charcoal is known for its excellent adsorptive capacity, which facilitates deep cleansing by binding impurities, toxins, and excess sebum from the skin surface.^[8,9] This property makes it particularly beneficial for individuals with oily and acne-prone skin. On the other hand, moringa, often referred to as a

nutrient-rich botanical, contains essential vitamins, minerals, and antioxidants that support skin hydration, repair, and protection against free radical damage.^[2,3] The integration of these two components into a dual layer system allows for a synergistic effect, combining detoxification with nourishment in a single formulation. Furthermore, the dual layer structure enhances product functionality and aesthetic appeal by enabling targeted delivery of active ingredients. The solid cube form also contributes to improved stability, ease of transportation, and extended shelf life, while addressing environmental concerns associated with plastic packaging in conventional liquid cleansers. This review discusses formulation techniques, selection of excipients, physicochemical properties, mechanism of action, and overall

benefits of dual layer charcoal and moringa face wash cubes. The findings suggest that such formulations hold significant promise in the development of sustainable, effective, and consumer-friendly skincare products.^[6]

KEYWORDS: Activated Charcoal, Moringa Extract, Dual Layer Formulation, Face Wash Cubes, Herbal Cosmetics, Sustainable Skincare.

INTRODUCTION

The global cosmetic and personal care industry is undergoing a significant transformation driven by increasing consumer awareness regarding skin health, ingredient safety, and environmental sustainability.^[13] Modern consumers are shifting from conventional synthetic-based products toward formulations that incorporate natural, biodegradable, and skin-friendly ingredients. This trend has accelerated research and development in herbal cosmetology, focusing on the utilization of plant-derived bioactive compounds with proven therapeutic potential.^[21]

Traditional liquid face cleansers, despite their widespread use, present several limitations such as high water content, the need for preservatives, potential microbial contamination, and reliance on plastic packaging, which contributes to environmental pollution. In addition, the presence of harsh surfactants and synthetic additives in some formulations may lead to skin irritation, dryness, and disruption of the skin barrier. To overcome these challenges, solid cleansing systems, particularly face wash cubes, have emerged as a promising alternative.^[20] These systems are typically waterless or low-moisture formulations that offer improved physicochemical stability, enhanced portability, and reduced environmental impact due to minimal packaging requirements.^[24]

Face wash cubes represent an innovative dosage form in cosmetic science, combining the benefits of solid soap systems with advanced formulation strategies. They are designed to deliver effective cleansing while maintaining skin hydration and integrity. The incorporation of functional ingredients in a structured matrix allows controlled release and targeted action, improving overall product performance. Furthermore, the compact and aesthetically appealing nature of cubes enhances consumer acceptance and usability.

Among the wide range of natural ingredients explored for skincare applications, activated charcoal and moringa have attracted considerable scientific and commercial interest.

Activated charcoal, a highly porous form of carbon, possesses exceptional adsorptive properties due to its large surface area and microporous structure. It effectively binds dirt, toxins, heavy metals, and excess sebum from the skin surface, thereby facilitating deep pore cleansing and detoxification. Its use is particularly beneficial in managing oily and acne-prone skin conditions.^[8]

Moringa (*Moringa oleifera*), often referred to as the “miracle tree,” is rich in essential nutrients including vitamins A, C, and E, minerals, amino acids, and phenolic compounds. These constituents exhibit strong antioxidant, anti-inflammatory, and antimicrobial activities, which contribute to skin protection, repair, and rejuvenation. Moringa extracts help in combating oxidative stress, maintaining skin hydration, and improving overall skin texture and appearance.^[2,4]

The concept of dual layer formulation introduces a novel approach in cosmetic product design by integrating two distinct layers with complementary functionalities into a single unit. This strategy allows for the separation of active ingredients that may differ in stability or function, while enabling their combined action during application. In dual layer charcoal and moringa face wash cubes, the charcoal layer primarily performs detoxification and cleansing, whereas the moringa layer provides nourishment, hydration, and antioxidant protection. This synergistic combination enhances the efficacy and multifunctionality of the formulation.

DUAL LAYER CHARCOAL AND MORINGA FACE WASH CUBES

Recent advancements in herbal cosmetology have emphasized the incorporation of plant-based ingredients and eco-friendly formulations in skincare products. Natural compounds are increasingly preferred due to their biocompatibility, reduced side effects, and multifunctional properties.

Activated charcoal has been extensively studied for its detoxifying and cleansing abilities. Its highly porous structure and large surface area enable efficient adsorption of impurities, pollutants, and excess sebum from the skin. Various studies have demonstrated its effectiveness in deep pore cleansing and management of acne-prone skin. Additionally, charcoal-based formulations have shown improved skin clarity and reduced oiliness without causing significant irritation when used in optimized concentrations.^[9,12]

On the other hand, *Moringa oleifera* has gained recognition for its rich nutritional and pharmacological profile. It contains essential vitamins, flavonoids, and phenolic compounds

that exhibit antioxidant, anti-inflammatory, and antimicrobial activities.^[3,5] Research indicates that moringa extracts can enhance skin hydration, promote collagen synthesis, and protect against oxidative stress induced by environmental factors such as UV radiation and pollution.^[4]

Solid cosmetic formulations, including cleansing bars and cubes, have been explored as sustainable alternatives to conventional liquid products. Studies highlight their advantages such as reduced water activity, improved stability, and lower requirement for synthetic preservatives. Moreover, solid formulations contribute to decreased plastic usage, aligning with global sustainability goals.^[23,24]

The concept of dual layer formulations has also been investigated in recent years for its ability to deliver multiple functionalities within a single product. By incorporating two distinct layers, formulators can separate active ingredients based on their physicochemical properties while ensuring their combined action during use. This approach enhances product performance, stability, and consumer appeal.

Although individual studies on charcoal, moringa, and solid formulations are well documented, limited research is available on their combined application in dual layer face wash cubes. Therefore, the integration of these components represents a novel and promising approach in the development of multifunctional, eco-friendly skincare systems.

Formulation Components

1. Activated Charcoal

Activated charcoal is a highly porous form of carbon with a large surface area, making it an excellent adsorbent. It plays a crucial role in the formulation by binding and removing dirt, toxins, environmental pollutants, and excess sebum from the skin surface. This results in deep pore cleansing and detoxification, making it especially beneficial for oily and acne-prone skin. Its presence in one layer of the cube ensures targeted cleansing action without affecting the stability of other active components.^[8]

2. Moringa Extract (*Moringa oleifera*)

Moringa extract is a nutrient-rich herbal ingredient containing essential vitamins such as A, C, and E, along with flavonoids, phenolic compounds, and minerals. It exhibits strong antioxidant, anti-inflammatory, and antimicrobial properties, which help in protecting the skin

from oxidative stress, reducing inflammation, and supporting skin repair. It also enhances skin hydration and improves texture, making it an ideal component for the nourishing layer of the formulation.^[3,6]

3. Base Material (Glycerin Base or Syndet Base)

The base forms the backbone of the face wash cube and is responsible for providing structure and consistency. Glycerin base contributes to transparency and moisturizing properties, while syndet bases are preferred for their mildness and skin-friendly pH, which closely matches the natural pH of the skin. The base also facilitates uniform distribution of active ingredients and ensures smooth application during use.^[16]

4. Surfactants

Surfactants are essential components that provide cleansing action by reducing surface tension and enabling the removal of dirt, oil, and impurities from the skin. They also contribute to foam formation, which enhances user satisfaction. Mild and non-irritating surfactants are generally preferred in facial formulations to avoid damage to the skin barrier and prevent dryness or irritation.^[18,19]

5. Humectants (e.g., Glycerin, Sorbitol, Propylene Glycol)

Humectants play a vital role in maintaining skin hydration by attracting moisture from the environment and retaining it within the skin. They prevent excessive dryness that may result from cleansing and help maintain skin softness, smoothness, and elasticity. Their inclusion ensures that the formulation remains gentle and suitable for regular use.^[16]

6. Binding and Structuring Agents (e.g., Stearic Acid, Cetyl Alcohol)

These agents are responsible for imparting hardness and structural integrity to the face wash cubes. They help in maintaining the shape and prevent deformation during handling, storage, and transportation. Additionally, they improve the texture of the formulation and ensure uniform consistency throughout the product.^[17]

7. Emollients

Emollients such as natural oils (coconut oil, almond oil) may be incorporated to provide additional skin-conditioning benefits. They help in softening the skin, reducing roughness, and preventing moisture loss. Emollients also contribute to a smooth and pleasant feel after application.^[21]

8. Preservatives

Preservatives are added in minimal quantities to prevent microbial growth and ensure product safety, particularly if the formulation contains some moisture. However, due to the low water content in face wash cubes, the requirement for preservatives is generally reduced compared to liquid formulations.^[22]

9. Fragrance

Fragrance is incorporated to enhance the sensory appeal of the product, making it more pleasant and attractive to users. It improves overall user experience and increases product acceptability.^[20]

10. Colorants

Colorants are used to improve the aesthetic appearance of the face wash cubes and to distinguish between the dual layers. Natural colorants are preferred in herbal formulations to maintain product safety and align with eco-friendly trends.^[21]

Method of Preparation

1. Selection and Weighing of Ingredients:

All required ingredients such as activated charcoal, moringa extract, base material (glycerin or syndet base), surfactants, humectants, and other excipients are accurately weighed using a digital balance. Proper measurement is essential to ensure uniformity, consistency, and reproducibility of the formulation.

2. Melting of Base Material

The base (glycerin or syndet) is melted using a water bath at a controlled temperature of approximately 60–70°C. Indirect heating is preferred to prevent degradation of ingredients and to maintain the stability of the formulation.

3. Preparation of Charcoal Layer

Activated charcoal powder is gradually added to a portion of the melted base with continuous stirring to ensure uniform dispersion and to avoid lump formation. Required excipients such as humectants, mild surfactants, and fragrance may be incorporated at this stage. The mixture is stirred until a homogeneous blend is obtained.

4. Pouring of First Layer

The prepared charcoal mixture is poured into pre-cleaned molds to form the first layer. The molds are then kept undisturbed at room temperature or under controlled conditions to allow partial solidification. This step is important to support the formation of a distinct second layer.

5. Preparation of Moringa Layer

In a separate container, moringa extract is mixed with the remaining melted base. Continuous stirring is carried out to ensure uniform distribution of the extract. Additional excipients such as humectants, colorants, and fragrance can be added as required.

6. Formation of Dual Layer Structure

Once the charcoal layer becomes semi-solid, the moringa mixture is carefully poured over it to form the second layer. This step must be performed gently to prevent mixing of layers and to maintain a clear separation between them.

7. Cooling and Solidification

The filled molds are allowed to cool at room temperature or under refrigeration until complete solidification occurs. Proper cooling ensures the development of adequate hardness and structural integrity of the cubes.

8. Demolding

After complete solidification, the face wash cubes are carefully removed from the molds. Care is taken to avoid breakage or deformation during this step.

9. Drying

The cubes may be air-dried for a short period to remove surface moisture and improve hardness, stability, and shelf life.

10. Packaging and Storage

The prepared cubes are packed in airtight, moisture-resistant containers to prevent exposure to humidity and contamination. Proper storage conditions help maintain the quality and longevity of the product.

Evaluation Parameters

1. Organoleptic Properties

The prepared face wash cubes are evaluated visually and sensorially for parameters such as color, odor, appearance, and texture. The cubes should exhibit a smooth and uniform surface, attractive appearance, and a pleasant odor. The dual layers (charcoal and moringa) must be clearly distinguishable without any cracks, air bubbles, or surface defects, indicating good formulation quality and consumer acceptability.^[13,20]

2. pH Determination

The pH of the formulation is determined by dissolving a small quantity of the cube in distilled water (usually 1% solution) and measuring it using a calibrated digital pH meter. The pH should ideally be in the range of 5.5 to 7, which is compatible with the natural pH of the skin. Maintaining this range is essential to prevent irritation, dryness, and disruption of the skin barrier.^[13,16]

3. Foamability and Foam Stability Test

Foamability is evaluated by dissolving the cube in water and shaking it in a graduated cylinder to measure foam volume. Foam stability is observed by recording the time for which the foam persists. Adequate foam formation indicates effective surfactant action, while stable foam ensures satisfactory cleansing performance and enhanced user experience.^[18,19]

4. Hardness Test

The hardness of the cubes is measured using a hardness tester or by applying manual pressure. This test determines the mechanical strength and durability of the formulation. Adequate hardness ensures that the cubes can withstand handling, packaging, transportation, and regular usage without breaking or deforming.^[17,23]

5. Moisture Content (Loss on Drying)

Moisture content is determined by drying the sample at a specified temperature and calculating the loss in weight. Low moisture content is desirable as it reduces the chances of microbial growth, enhances stability, and increases shelf life of the product.^[22]

6. Skin Irritation Test

The safety of the formulation is evaluated through patch testing on human volunteers or suitable models. The cubes are applied on a small area of skin and observed for any signs of

irritation such as redness, itching, or swelling. Absence of such reactions indicates that the formulation is safe and suitable for topical application.^[15]

7. Stability Studies

Stability testing is carried out by storing the product under different environmental conditions such as room temperature and elevated temperature (e.g., 40°C). The cubes are periodically evaluated for changes in color, odor, pH, texture, and structural integrity. This test helps in determining the shelf life and long-term stability of the formulation.^[22]

8. Cleansing Efficiency Test

This test evaluates the ability of the face wash cubes to remove dirt, oil, and impurities from the skin. It can be assessed by applying the formulation on skin or a suitable surface containing oil or dust and observing the cleaning effectiveness. High cleansing efficiency indicates good performance of surfactants and charcoal.^[8,18]

9. Layer Integrity Test (Specific for Dual Layer Formulation)

This test ensures that the two layers remain intact during storage and handling. It also evaluates how the layers interact during application. Proper layer integrity indicates successful formulation and ensures that both cleansing (charcoal) and nourishing (moringa) functions are effectively delivered.^[23]

10. Spreadability Test

Spreadability is evaluated by applying the product on the skin to observe how easily it spreads. Good spreadability ensures ease of application, uniform coverage, and better interaction of active ingredients with the skin surface.^[20]

11. Solubility and Washability Test

This test determines how easily the cube dissolves in water and how effectively it rinses off from the skin. The formulation should dissolve at an optimal rate, producing sufficient lather without leaving any residue.^[18]

12. Microbial Load Test

The formulation is tested for microbial contamination by determining the presence of bacteria, fungi, or other microorganisms. Low or negligible microbial count ensures product safety, hygiene, and compliance with quality standards.^[22]

Future Aspects

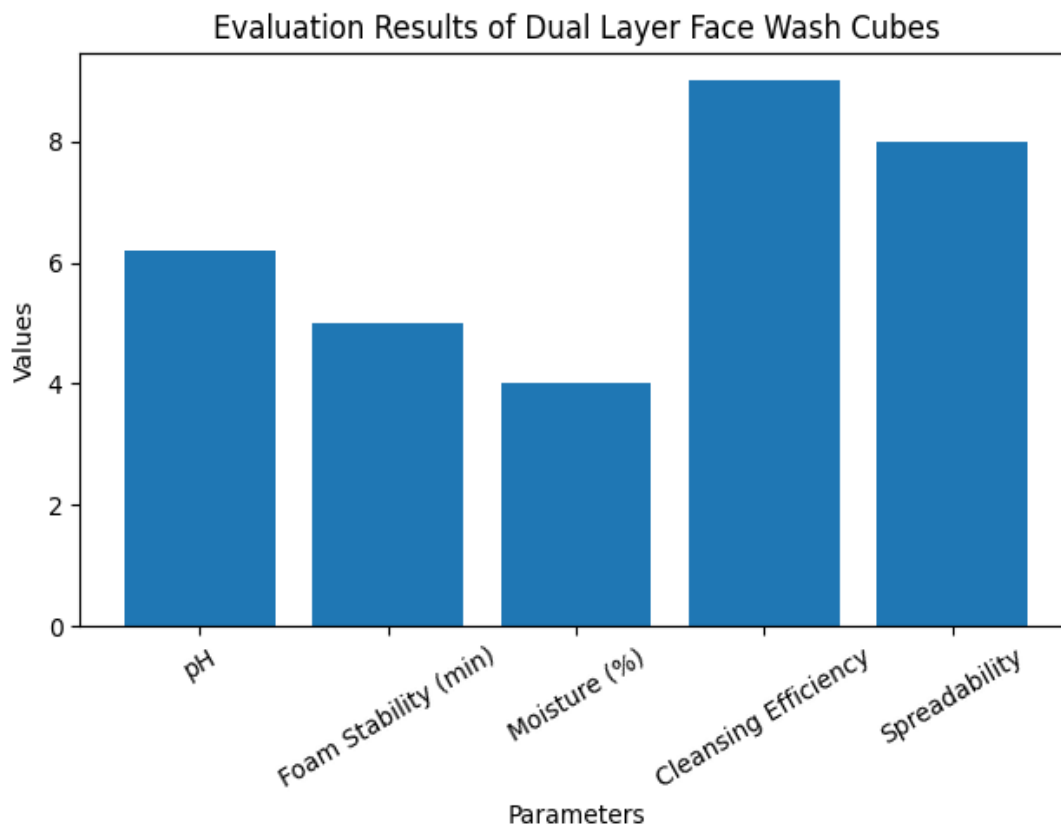
Dual layer charcoal and moringa face wash cubes have significant potential for future development in the cosmetic field. Further research can focus on incorporating additional herbal ingredients to enhance multifunctional benefits such as anti-aging, skin brightening, and acne control. The development of customized formulations based on different skin types is another promising area, allowing more targeted and effective skincare solutions.^[13]

Advancements in formulation technology may improve layer stability, controlled release of active ingredients, and overall product performance. The use of modern delivery systems such as nanoformulations can further enhance the penetration and effectiveness of bioactive compounds. Additionally, increasing emphasis on sustainable and eco-friendly products will drive the adoption of such solid, low-waste formulations.^[22]

Future work should also include clinical and dermatological studies to validate safety and efficacy, along with efforts toward large-scale manufacturing and commercialization. Overall, these formulations have strong potential to become an important part of next-generation, sustainable skincare products.^[15,22]

RESULT

The dual-layer charcoal and moringa face wash cubes showed satisfactory physicochemical and performance characteristics. The formulation exhibited a skin-friendly pH (5.8–6.5), moderate foamability, and good cleansing efficiency. The cubes possessed adequate hardness, low moisture content, and clear dual-layer separation. No signs of skin irritation or microbial contamination were observed. Stability studies indicated no significant changes in color, odor, or texture.



COMPARATIVE ANALYSIS WITH CONVENTIONAL PRODUCTS

Parameter	Dual Layer Cubes	Liquid Face Wash
Stability	High	Moderate
Eco-impact	Low	High
Shelf life	Longer	Shorter
Portability	High	Low

CONCLUSION

Dual layer charcoal and moringa face wash cubes represent an innovative and effective approach in modern cosmetic formulations, combining the benefits of deep cleansing and skin nourishment in a single product. Activated charcoal provides efficient removal of

impurities, toxins, and excess oil, while moringa extract contributes antioxidant, anti-inflammatory, and moisturizing effects, resulting in improved skin health and appearance. The dual layer system enhances functionality by delivering these benefits simultaneously, while the solid cube format offers advantages such as improved stability, portability, and reduced environmental impact.

Furthermore, the use of natural ingredients and minimal packaging aligns with the growing demand for sustainable and eco-friendly skincare products. Evaluation parameters indicate that such formulations are safe, stable, and cosmetically acceptable. Overall, dual layer charcoal and moringa face wash cubes demonstrate significant potential as a multifunctional and environmentally responsible alternative to conventional liquid cleansers, with promising applications in both research and commercial sectors.

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