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Formulation and Evaluation of Activated Charcoal peel off Mask

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Abstract:

In today's world, where skincare is a growing priority, this project focuses on developing a natural and effective peel-off face mask using activated charcoal and other skin-loving ingredients. The goal is to create a product that not only deeply cleanses the skin but is also easy to use and gentle on all skin types. Activated charcoal is the key ingredient, known for its powerful ability to draw out dirt, oil, and impurities from deep within the pores. Polyvinyl alcohol is used to give the mask its peel-off texture, while glycerin and aloe vera gel help keep the skin moisturized and soothed.to boost the mask's benefits, neem powder has been added for its natural antibacterial and acne-fighting properties, and orange peel powder provides vitamin C and antioxidants that brighten the skin and improve overall texture. A touch of tea tree oil enhances the mask's anti-inflammatory and antimicrobial effects, and a light fragrance gives it a refreshing finish.The mask was tested for PH, viscosity, drying time, ease of application, and user satisfaction. Results showed it to be safe, effective, and user-friendly- offering a budget-friendly, natural solution for deep cleansing and glowing skin. Unlike conventional peel-off masks formulated with synthetic chemicals that may disrupt sebaceous gland function and compromise the skin's natural barrier, the present formulation employs natural, plant-based ingredients to provide effective cleansing while maintaining skin integrity and promoting dermatological health.

Keywords: Activated charcoal, Peel-off mask, Natural skincare, Polyvinyl alcohol, Aloe vera, Neem, Orange peel, Tea tree oil, Antibacterial, Antioxidant, Anti-inflammatory, Skin cleansing, Herbal formulation, PH.

Introduction:

In recent years, the global skincare industry has witnessed a significant transformation driven by increasing consumer awareness, a preference for natural ingredients, and the pursuit of products that offer both functionality and convenience. One such innovation is the charcoal peel-off mask, a formulation designed to provide deep pore cleansing, detoxification, and exfoliation in a single-use product. With rising pollution levels, stress, and irregular lifestyle habits contributing to various skin concerns such as blackheads, acne, and dullness, there is a growing demand for effective skincare solutions that are both quick-acting and non-invasive

The primary active component in this formulation, activated charcoal, is renowned for its high adsorption capacity and ability to bind with toxins, sebum, and other impurities from the skin's surface.[11] Activated charcoal is processed at high temperatures to increase its porosity, making it an ideal ingredient for removing deeply embedded dirt and excess oil from clogged pores. The inclusion of polyvinyl alcohol (PVA) in the formulation serves as a film-forming agent that enables the mask to be peeled off easily,[3] removing dead skin cells and blackheads in the process. Additional components such as aloe vera extract provide hydration and a soothing effect, while essential oils may contribute antibacterial, anti-inflammatory, or aromatherapeutic benefits[13]

This study aims to formulate and evaluate a stable, skin-friendly charcoal peel-off mask with desirable aesthetic and functional characteristics. Various physicochemical and in vitro tests were performed to assess the quality and performance of the formulation, including:

Organoleptic test, pH test, Irritation test, Spreadiblity test, Peel off test.

In addition to meeting current consumer expectations for instant and visible results, the charcoal peel-off mask addresses the need for eco-conscious and multifunctional skincare solutions. Unlike traditional cleansers or exfoliates peel-off masks offer a more engaging user experience and a sense of satisfaction upon physical removal of the mask and visible impurities.

The current relevance of such products is underscored by their wide usage in both professional skincare routines and at-home applications. As consumer demand continues to shift toward natural, cruelty-free, and sustainable beauty products, this formulation has the potential to be positioned within a clean beauty portfolio.

Materials and Methods:

The preparation of the charcoal face mask involved the use of natural products such as:

Table no.1 Materials Used

Sr.no	Materials	Percentage	Quantity (50g)	Purpose
1.	Activated Charcoal	20%	10g	Adsorbs dirt, toxins and excess oil , primary cleansing agent
2.	Aloe vera gel	20%	7.5g	Moisturizes and soothes the skin; add smoothness to the texture
3.	Nutmeg Powder	5%	2.5g	Provide exfoliation and also has Anti-inflammatory Antioxidant Property
4.	Turmeric Powder	5%	2g	Anti-inflammatory and Brightening effect
5.	Neem Powder	10%	2.5g	Antifungal
6.	Orange peel Powder	10%	2.5g	Helps tone the skin and reduce oiliness
7.	Polyvinyl Alcohol	20%	10g	Provide structure to the mask
8.	Glycerine	10%	5ml	Humectant
9.	Distilled Water (q.s)	10%	5ml	Act as a solvent
10.	Lavender Oil	1%	0.5ml	Provide fragrance
		100%	50g	

Plant Based Materials Used:

1) The activated charcoal powder used in the formulation was directly obtained from the laboratory stock.

figure no.1 Charcoal powder

2**)Neem Powder**:

Biological name: Azadirachta Indica Family: Meliaceae

Neem powder used in the preparation of the charcoal peel-off mask was self-prepared. Fresh neem leaves were collected, thoroughly washed with distilled water, and left to dry in a shaded area at room temperature for 2–3 days. Once completely dried, the leaves were finely ground using a clean grinder to obtain a smooth neem powder, which was then stored in an airtight container for further use in the formulation.

figure no.2 Neem Powder

3)Turmeric Powder:

Biological name: Curcuma longa Family : Zingiberaceae

Raw turmeric was obtained and dried thoroughly then grind into fine powder and later added to charcoal peel off mask.

figure no3: Turmeric powder

4**) Nutmeg Powder:**

Biological name: Myristica fragrans Family: Myristicaceae

Figure no:4 Nutmeg Powder

5) Orange Peel Powder:

Biological name: Citrus sinensis Family: Rutaceae

Orange peel powder was prepared by manually peeling fresh raw oranges, followed by thorough washing, sun-drying the peels for 5–7 days under hygienic conditions, and then grinding them into a fine powder using a mechanical grinder.

Figure no: 5 Orange peel powder

6)Aloevera Pulp:

Biological name: Aloe barbadensis miller Family : Asphodelaceae (formerly Liliaceae)

Aloe vera pulp was obtained by thoroughly washing fresh Aloe vera leaves, cutting off the thorny edges, peeling away the outer green layer, and scooping out the inner transparent extracted gel was then filtered to remove any impurities and used in the preparation of the

Figure no.6: Aloevera pulp

Method of Preparation:

- All ingredients were accurately weighed using an analytical balance to ensure precision in the formulation. Turmeric powder and nutmeg powder were initially triturated using a clean mortar added sequentially, with continuous trituration after each addition to ensure a homogenous mixture.

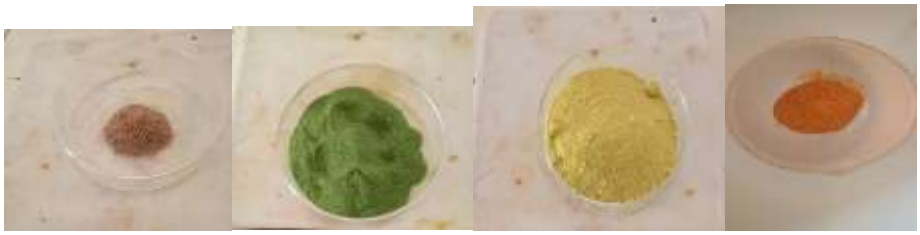

fig no.7 (a) fig no. 7 (b) fig no. 7(c) fig no.7 (d)

fig no 7 (a) Nutmeg Powder, (b) Neem Powder (c) Orange Peel Powder (d) Turmeric Powder

- A polyvinyl alcohol (PVA) gel base was prepared by dissolving PVA in distilled water at a concentration of 10–15% w/v. The mixture was heated to a temperature range of 70–90°C with continuous stirring until a clear and viscous solution was obtained. The solution was then allowed to cool to room temperature.

Figure no. 8 Preparation of PVA gel base

- Activated charcoal was then incorporated into the herbal powder blend and mixed thoroughly to achieve uniform dispersion. Fresh aloe vera pulp, previously filtered and homogenized to a smooth consistency, was added to the mixture and stirred until evenly distributed.
- The prepared herbal-charcoal-aloe mixture was gradually added to the cooled PVA gel base under continuous stirring to form a consistent and uniform peel-off mask formulation. A suitable perfuming agent was added to enhance the sensory attributes of the final product.

Figure no.9 Incorporation of Activated Charcoal

- The formulation was subjected to thorough homogenization and then transferred into appropriate, airtight containers for storage and further evaluation.

Figure no.10 Final Formulation

Evaluation Tests of Peel off Mask

1)Organoleptic Test [21]

Table no.2 Organoleptic Test

Parameters	**Observation**
Appearance	Smooth, thick gel like paste
Color	Uniformly Black
Texture	Smooth and even, non-gritty
Consistency	Homogenous, easy to spread
Drying behavior	Dries within 15-25 min, forms a flexible form
Peel-off quality	Peels off easily

2) **PH Test**: The pH of the charcoal peel-off mask was measured to evaluate its compatibility with human skin, as an ideal topical formulation should maintain a pH close to that of the skin (typically 4.5–6.5) to avoid irritation and maintain skin barrier function.[20]

Procedure:

1. A small quantity (approximately 1 g) of the charcoal mask formulation was transferred into a clean beaker.
2. The sample was diluted with 10 mL of distilled water to facilitate uniform dispersion and improve the accuracy of the pH reading.
3. The mixture was stirred thoroughly using a clean glass rod until a homogeneous suspension was obtained.
4. A universal pH indicator strip was immersed into the prepared solution for a few seconds, then removed.
5. After allowing the strip to develop color for 15–30 seconds, the resulting color was compared against the standard color chart provided with the pH strips.

Result: This pH falls within the optimal range of 5.6 which is considered safe for topical application and compatible with the natural pH of human facial skin. The mildly acidic nature of the formulation suggests minimal risk of skin irritation and supports its suitability for cosmetic

3) **Irritancy Test**: To evaluate the skin compatibility of the formulated charcoal peel-off face mask, an irritancy test was performed on a small group of human volunteers (n = 10) following ethical approval and informed consent. A patch test method was employed wherein a small quantity of the formulation was applied to the inner forearm of each subject and left undisturbed for 30 minutes. The area was then observed at intervals of 1 hour, 24 hours, and 48 hours post-application.

The skin was assessed for any signs of erythema (redness), edema(swelling), itching, or rash. Each reaction was graded using standard visual scoring scale.

Table no.3 Irritancy Test Result.

Score	Reaction
0	No reaction
1	Slightly erythema
2	Moderate erythema
3	Severe erythema or edema

Result: All 10 volunteers showed a score of 0, indicating no visible signs of irritation or allergic reactions. The irritation index was calculated to be 0.0, confirming that the developed face mask formulation is non- irritant and suitable for topical use.

4)Spreadability Test: Spreadability is an important parameter for topical formulations, as it determines how easily the product can be applied to the skin. A good spreadability value ensures uniform application and enhances user experience.

Method: The spreadability of the formulated charcoal peel-off mask was determined using the slip and drag method. In this method, 1 g of the formulation was placed between two glass slides of standard dimensions (10 cm × 2 cm). A known weight (500 g) was placed on the upper slide for 5 minutes to compress the sample and ensure uniform thickness. The time taken by the upper slide to slip off under the influence of an applied weight (20 g) was recorded in seconds. [5]

Spreadability (S) was calculated using the formula:

$S = (M \times L) / T$

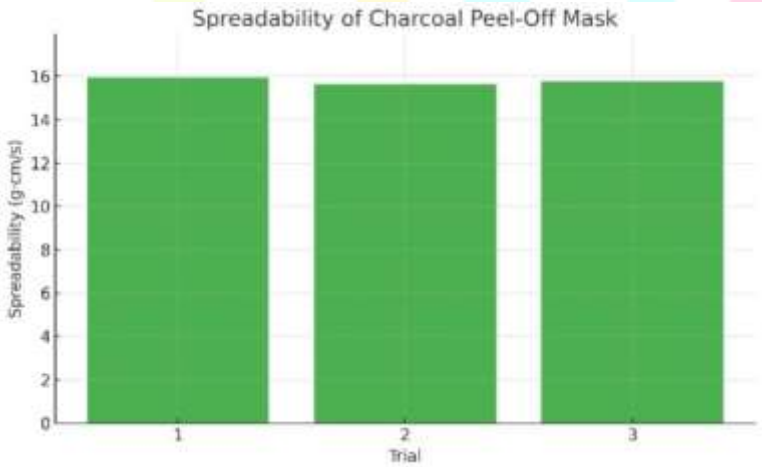

Table no.4: Spreadability test Results

Trial	Time (s)	Weight (g)	Length (cm)	Spreadability (g.cm/s)
1	9.4	20	7.5	15.96
2	9.6	20	7.5	15.62
3	9.5	20	7.5	15.79

Average Spreadability = 15.79g*cm/s

Result:

The average time recorded for the slide to slip was 9.5 seconds. This value indicates that the formulation possesses good spreadability, ensuring ease of application without being too runny or too thick.

4) Peel-Off Property Test:

The peel-off property of the formulated charcoal face mask was evaluated to determine its ease of removal and film integrity. A thin, even layer was applied to the dorsal hand surface and allowed to dry at room temperature, taking approximately 20–25 minutes. Upon drying, the film was peeled off gently from one edge. The mask removed smoothly in a single sheet without tearing, demonstrating excellent film-forming ability. The film was flexible, strong, and left no residue or irritation on the skin. These observations confirm that the formulation exhibits ideal peel-off characteristics suitable for cosmetic use, ensuring user comfort.[6]

Fig no .11 (a)

Fig no.11 (b)

Figure no. 11 Peel off Test

Result:

The formulated charcoal peel-off mask aimed to provide effective skin cleansing, oil control, and pore purification using activated charcoal as the key functional ingredient and polyvinyl alcohol (PVA) as the film-forming base. The formulation process focused on achieving a homogenous, stable, and skin-friendly product that could be easily applied and removed without causing irritation.

To assess the overall quality and performance of the mask, various tests were carried out including homogeneity, appearance and texture, peel-off ability, drying time, pH, post-application skin feel, and short-term stability. These evaluations help determine the suitability of the formulation for cosmetic use, particularly for individuals with oily or acne-prone skin.

Table no .5 Result

Parameters	Observation	Discussion
Homogeneity	Smooth Uniform Gel with evenly dispersed charcoal particles	Indicate proper mixing and stability: ensure consistent application and performance
PH Test	within range of 5.6	Skin Compatible, safe for topical application
Appearance and Texture	thick black jelly with glossy appearance and smooth texture	Aesthetic and user friendly :easy to apply and spread evenly on the skin
Peel off property	Forms a flexible cohesive film that peels of in one place	Effective removal of impurities without skin irritation
Drying Time	15 – 20 minute (depending on layer thickness)	Acceptable for cosmetic use balance
Skin feel after use	Skin felt for smoother cleanser less oily	Cleansing and oil controls without causing dryness or irritation
Stability	No changes in color texture or odor : no microbial growth in observed	Suggest for short term stability and shelf life under ambient condition

Discussion: The formulated activated charcoal peel-off mask exhibited desirable cosmetic and functional properties, supporting its potential as a natural, skin-friendly skincare product. With a measured pH of 5.6, the formulation aligns well with the skin's natural acidity, ensuring minimal risk of irritation.The absence of adverse reactions during the irritancy test confirms its dermatological safety. Good spreadability and excellent peel-off

performance reflect effective formulation, mainly due to the presence of polyvinyl alcohol as the film-forming agent.

The inclusion of natural ingredients such as neem, turmeric, orange peel, and aloe vera contributed additional benefits like antimicrobial, antioxidant, and soothing effects—making the product suitable for oily and acne-prone skin. Furthermore, short-term stability indicated no microbial growth or physical changes, suggesting good shelf-life potential under ambient conditions. the formulation meets consumer expectations for clean, effective, and easy-to-use skincare products. Further testing, such as long-term stability and preservative efficacy, could enhance the product's commercial readiness. In comparison to commercial synthetic masks, this herbal-based formulation provides a cost-effective, natural, and skin-friendly alternative, aligning with current trends in clean and green beauty products. However, further long-term stability studies and microbial load testing are recommended to determine shelf life and ensure preservation efficacy.

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