



# SUSTAINABLE RADIANCE: FORMULATING AND DEVELOPING COCONUT SHELL CHARCOAL SCRUB FOR ECO-FRIENDLY SKIN CARE SOLUTION

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## ABSTRACT

Exfoliation pertains to elimination of impaired skin cells from the outmost layer of epidermis, generally occurring naturally or facilitated through mechanical, chemical, or enzymatic methods. Face scrub is formulated to exfoliate the skin. It typically contains abrasive particles that aid in the removal of dead skin cells. By promoting cell turnover and employing physical abrasion, it has the potential to remove dead skin cells and improve skin texture. In India, worship is an integral part of daily life and individuals present a variety of offerings to deities. Among other forms of offerings, coconuts are found in huge quantities. Coconut shells have the potential to be repurposed for numerous environmental-friendly initiatives. By recycling temple waste, we actively contribute to take a step forward in sustainability and the mitigation of negative environmental effects. The objective of the current study is to assess the exfoliating properties of coconut shell charcoal. It was obtained from the controlled burning of thoroughly dried and mature coconut shells in a limited oxygen supply. Particle size of coconut shell charcoal was detected and found to be 105µm. To check efficacy and exfoliating property of charcoal powder, face scrub was formulated with different concentrations of active. For exfoliation activity, the tape stripping method was performed. In this method, adhesive films are used to remove the cell layer of the stratum corneum from pre-determined

areas of the skin. The study unveiled that coconut shell charcoal containing natural active possesses ability to improve skin cleansing by effectively eliminating dead skin cells as well as blackheads and whiteheads. Efficacy study on exfoliating properties was conducted using various concentrations of coconut shell charcoal in a selected base. Study data with active was collected and the concentration that gave excellent exfoliating property was found to be at 1.5%.

**Keywords**—Exfoliation, abrasive particles, sustainability, temple waste, coconut shell charcoal.

## I. INTRODUCTION

The process of exfoliation involves removing the top layer of dead skin cells, also known as the stratum corneum, from the surface of the skin <sup>[1]</sup>. This stratum corneum is composed of keratinized cells that are continually sloughed off and rejuvenated by fresh cells originating from the skin's underlying layers. The practice of exfoliation accelerates the shedding process and eliminates dead skin cells, facilitating the emergence of fresh, new skin cells <sup>[2]</sup>. Apart from enhancing the skin's overall appearance, exfoliation aids in pore unclogging, removal of blackheads and whiteheads, and prevention of breakouts <sup>[3][4]</sup>. Additionally, exfoliation can also increase the absorption of skincare products, as it eliminates the barrier of dead skin cells, it allows them to penetrate into the skin. One of the most popular ways to exfoliate the skin is through the use of face scrubs. A face scrub is a product that contains tiny abrasive particles that gently exfoliate the skin, resulting in a smoother, brighter complexion <sup>[5-7]</sup>.

In India, worship is an integral part of daily life and individuals present a variety of offerings to deities. Among other forms of offerings, coconuts are found in huge quantities. Coconut shells have the potential to be repurposed for numerous environmental-friendly initiatives<sup>[8]</sup>. Coconut shell charcoal is an excellent ingredient that can be used to create an eco-friendly face scrub<sup>[9]</sup>. The coconut tree (*Cocos nucifera*) is a member of the palm tree family (*Arecaceae*) and the only living species of the genus *Cocos*. Coconut charcoal is derived from coconut shell, and it may effectively cleanse the skin, unclogs pores, remove deeper impurities, and dead skin cells. The result is smooth and even-toned skin<sup>[10][11]</sup>. The mechanism behind is that the dirt, toxins, heavy metals, chemicals, and other impurities are attracted to the charcoal molecules and washed away. Coconut shell charcoal is also known for its ability to absorb excess oil and detoxify the skin, making it an ideal ingredient for those with oily or acne-prone skin. It can also help to minimize the appearance of pores, giving the skin a smoother and more refined texture<sup>[12]</sup>. The study explores how coconut shell charcoal can be utilized in formulating an eco-friendly face scrub and the advantages of using temple waste coconut shells for producing abrasive particles.

## II. MATERIALS AND METHOD

### A. COLLECTION OF COCONUT SHELL

The coconut shells were procured from temples of Nagpur region.

#### a) Preparation of Coconut shell charcoal:

Coconut shell charcoal was obtained using a Pit method, it is a traditional method which involves placing thoroughly dried and mature coconut shells inside a pit, covering them with soil, and allowing them to burn in a limited oxygen supply for 5 days. The burning of clean, dried and mature coconut shells in a controlled environment results in the production of good quality Charcoal<sup>[13][14]</sup>.

#### b) Preparation of Coconut shell charcoal particles:

In order to achieve uniform-sized particles, the coconut shell charcoal was crushed into

coarse particles with a mortar and pestle, followed by utilizing a sieve to ensure uniformity in particle size.

### B. FORMULATION AND DEVELOPMENT OF COCONUT SHELL CHARCOAL FACE SCRUB<sup>[15]</sup>

To formulate an eco-friendly coconut shell charcoal face scrub, one of the key considerations is the mesh size of the charcoal used. The particle size of the coconut shell charcoal selected was 105  $\mu\text{m}$ .

#### a) Preparation of base:

Two formulations were conducted to select the base. Formulation F2 was chosen based on its good consistency, appearance and spreadability.

**Table: Incorporation of active in selected base F2:**

Sr. no	Ingredients (100gm)	Trial 1 (F1)	Trial 2 (F2)	Trial 3 (F3)
1	Bentonite Clay	5	5	5
2	Glycerine	8	8	8
3	Rose Water	20	20	20
4	Water	Up to 100ml	Up to 100ml	Up to 100ml
5	Coconut shell charcoal	1	1.5	2
6	Tea Tree Oil	0.2	0.2	0.2

### C. EVALUATION OF FINISHED PRODUCT

The primary concern regarding cosmetic formulation is the durability of the final product when stored at various temperatures: room temperature (26  $^{\circ}\text{C}$ ), refrigerator (4 $^{\circ}\text{C}$ ), and freezer (−18  $^{\circ}\text{C}$ ) for a period of 30 days.

#### a) Colour Stability test<sup>[16]</sup>

The final finished product sample was kept at the mentioned temperatures and then colour was observed visually.

#### b) Odour stability test<sup>[16]</sup>

The final finished product sample was kept at the mentioned temperatures and then the odour was analysed by smelling the product.

#### c) Spreadability test<sup>[17]</sup>

A small amount of face scrub was placed on the glass slide and another glass slide was placed over

it. A wooden weight was placed on the slides. The time required for the face scrub to spread, and the area was measured. The amount and the area of face scrub on the glass slide represents the efficiency of spreadability.

#### d) Tape stripping method <sup>[18]</sup>

The area of skin of the forearm was predetermined with the use of adhesive tape to get the skin cell layer. The product was applied on skin and rubbed gently. After scrubbing, again an adhesive tape was applied and was gently removed to collect the cell layer of stratum corneum and the collected cells were then examined under a microscope to determine the amount of exfoliation achieved.

#### e) pH of the face scrub

The pH meter was calibrated using a standard buffer solution. About 0.5g of the face scrub was weighed and dissolved in 50.0ml of distilled water and its pH was measured using a pH meter.

### D. SUBJECTIVE EVALUATION OF FINISHED PRODUCT

Thirty volunteers were selected to assess the effectiveness of coconut shell charcoal face scrub.

#### a) Evaluation Procedure

Prior to evaluation, every participant was provided with a questionnaire designed to determine their skin type and collect pertinent background details which can be helpful in the conclusion.

30 volunteers were selected, who were having blackhead/whitehead.

The participants were instructed to adhere to the following regimen for using the products:

1. Subjects were instructed to use the product during either the daytime or evening hours.
2. Subjects were directed to follow these steps for using the product.
3. Apply the recommended amount of scrub to the face using circular motions for 1 to 2 minutes, allow the scrub to sit on the face for 5 minutes and cleanse the face with tap water or wet wipes.

- Assessment parameters included removal of blackhead and whitehead, moisturizing

effect, Spreadability, no-irritation and cleansing.

- Assessment of parameters was done based on the grading scale-condition of the face area.

### III. RESULT AND DISCUSSION

The coconut shells were procured from temples of Nagpur region.

Charcoal made from coconut shells was obtained using the pit method.

The particle size of the coconut shell charcoal selected was 105  $\mu\text{m}$ .

#### A. INCORPORATION OF ACTIVE IN SELECTED BASE F2:

Coconut shell charcoal powder was added at different concentrations [1%, 1.5%, and 2%] in selected base and checked for various parameters for its quality.



Image 1: Coconut shell charcoal face scrub.

#### B. EVALUATION OF FINISHED PRODUCT:

- a) **Colour stability** - Colour of the finished product was found to be stable at room temperature (26°), refrigerator temperature (4°) and oven temperature (45°)
- b) **Odour stability** - Odour of the finished product was found to be stable at room temperature (26°), refrigerator temperature (4°) and oven temperature (45°).
- c) **Spreadability** - The product showed excellent spreadability and it effortlessly and uniformly covered the surface.
- d) **Tape stripping method** - The product effectively cleansed the dead skin cells as well as blackheads and whiteheads.
- e) **pH of the face scrub** - The pH of the coconut shell face scrub was found to be in range of 5.6 to 6.8 which is good for skin pH.

**C. SUBJECTIVE EVALUATION OF FINISHED PRODUCT****Result:**

Table no 2. Rating of subjective evaluation after use of finished product.

Subject Identity				Scaling of finished product after use			
Sr.no	Sex	Age	Skin Type	Removal of blackhead and whitehead	Moisturizing and Spreadability effect	Irritation	Cleansing
1	F	24	Normal	1	3	0	1
2	M	33	Oily	1	2	1	1
3	M	27	Oily	2	3	1	3
4	M	31	Oily	3	1	0	2
5	F	27	Combination	2	2	0	1
6	F	36	Combination	2	2	0	2
7	F	22	Normal	3	1	0	2
8	F	30	Oily	1	2	0	2
9	F	34	Oily	1	3	0	3
10	M	25	Oily	1	1	0	3
11	M	27	Combination	1	2	0	3
12	F	21	Combination	2	2	1	2
13	F	22	Oily	2	3	0	2
14	F	25	Normal	0	2	0	3
15	F	28	Oily	2	2	1	1
16	M	27	Combination	2	1	0	2
17	M	23	Oily	1	2	0	2
18	M	24	Normal	1	1	0	2
19	F	23	Combination	0	3	0	3
20	F	25	Normal	1	2	0	1
21	M	24	Oily	2	2	1	2
22	M	26	Normal	1	2	1	1
23	F	27	Combination	1	2	0	2
24	F	31	Oily	2	1	1	2
25	F	22	Combination	1	2	0	3
26	M	28	Oily	2	3	1	3
27	F	23	Oily	1	2	1	1
28	F	29	Combination	2	2	0	2
29	F	21	Normal	3	1	0	2
30	F	24	Combination	2	1	0	2
Mean		26.3		1.5	1.9	0.3	2

Abbreviations for Indicating Removal of Blackheads and Whiteheads:  
0- No

1- Less  
2- Moderate  
3- Excessive

Abbreviations for Indicating Moisturizing and Spreadability effect:

- 0- No
- 1- Fair
- 2- Good
- 3- Excellent

Abbreviations for Indicating Irritation

- 0- No
- 1- Mild
- 2- Moderate
- 3- Severe

Abbreviations for Indicating Cleansing effect

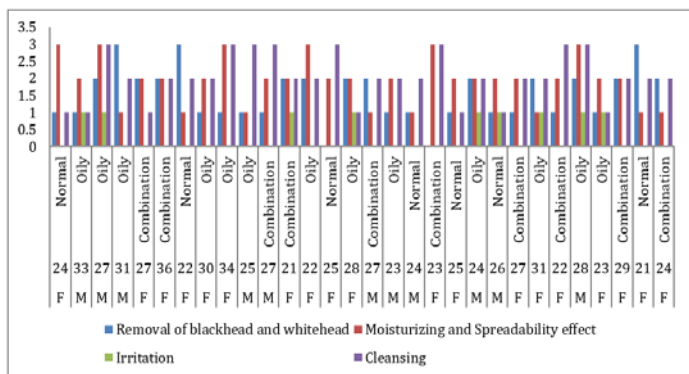
- 0- Not good
- 1- Good
- 2- Very good
- 3-Excellent



Image 2. Before application. Image 3. After application.

Graph 1. Result of subjective evaluation.

**Result-** Coconut shell charcoal face scrub



containing 1.5% concentration of active showed excellent activity in the given parameters (moisturizing, cleansing and removal of blackheads and whiteheads).

### VI. CONCLUSION

The Coconut Shell Charcoal face scrub with 1.5% active showed excellent spreadability and exfoliating properties without causing skin irritation or edema. It effectively

minimizes pores, enhances skin cleansing, and retains moisture. We can conclude that utilizing coconut shell, which is a natural resource, we can reduce our reliance on synthetic materials and create a more sustainable and environmental-friendly future.

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