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Research Article

A Research on Formulation and Evaluation of Herbal Soap

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ABSTRACT

Most of the commercial soaps contain chemicals that can be harmful to the skin and using a natural herbal soap can be a good alternative. Herbal soaps are made using natural herbs and ingredients that are healthier and beneficial for the skin and are less likely to cause any damaging effect. Some of the natural soap manufacturers also use aroma therapy and herbal treatments to offer the best skin treatment solution for your skin. Made of rare herbs and 100% natural ingredients, herbal soaps have found to be highly beneficial for the skin. These are characteristically different from soaps made from divalent metals such as magnesium, calcium, aluminum or iron which are not water soluble, Soaps are use for laundry and cleaning purposes, though the used of calcium soap in the formulation of animal feed have been reported. It is generally known that soap is produced by the saponification of a triglyceride (fat or oil). In the process the triglyceride is reacted with a strong alkali such as; potassium or sodium hydroxide to produce glycerol and fatty acide salt. Herbal soaps have gained significant attention in recent years due to increasing awareness regarding the harmful effects of synthetic chemicals present in conventional soaps. The present study focuses on the formulation and evaluation of herbal soap using natural plant-based ingredients possessing therapeutic and cosmetic benefits. Herbal ingredients such as neem, aloe vera, turmeric, tulsi, and essential oils were selected for their antimicrobial, anti-inflammatory, antioxidant, and skin-nourishing properties. Herbal soaps are natural cleansing formulations prepared using plant-based ingredients such as oils, extracts, and essential phytoconstituents. The formulation of herbal soap typically involves the process of saponification, where fatty acids from natural oils like coconut oil, olive oil, and palm oil react with alkali to produce soap, followed by incorporation of herbal extracts possessing antimicrobial, antioxidant, and skin-nourishing properties. Common herbal ingredients include neem, tulsi, aloe vera, turmeric, and sandalwood, which enhance therapeutic and cosmetic benefits.

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INTRODUCTION

Theophrastus, a Greek philosopher, classified plants into three categories: trees, shrubs, and Herbs. Three categories of herbs were originally recognized: sweet herbs (like thyme), salad Herbs (like wild celery), and pot herbs (like onions). Pot herbs started to be referred to be Vegetables around the seventeenth century as a result of selective breeding that altered the Plants' size and flavor away from those of the wild plant. At that point, they were no longer, Only thought to be fit for pots. Herbal soaps are skin-purifying and skin-beautifying products. The primary benefit of utilizing Herbal cosmetics is their purity, which leaves the body rich in nutrients and other beneficial Minerals instead of causing any negative side effects. Individuals' skin and hair beauty is Influenced by their health, lifestyle choices, regular occupation, environment, and upkeep. Summertime dehydration from prolonged heat contact to the skin results in wrinkles, freckles, Blemishes, pigmentation, and sunburns

The majority of commercial soaps on the market today have chemical ingredients that have Antibacterial action and may be able to depilate skin infections. Soaps and detergents are Considered disinfectants that are necessary for everyday hygiene routines. Cleaning agents, Such as soaps, can be liquid, solid, semisolid, or powdered. In order to preserve health and Beauty and get rid of odors from the body or inanimate objects, such as clothing, they are ued To eliminate dirt, including dust, bacteria, stains, and unpleasant smells. Commercial soap is Typically composed of harmful substances such plastics, aluminum, barium, mercury, and Bisphenol, among others. These substances are vaporized and absorbed through the skin, both Of which have detrimental side effects on the body The usage of herbal medicines has increased dramatically in the last several years. It is Believed that around 80% of the world's population uses herbal plant extracts in their Medicines, both in developed and developing nations. It is recognized as one of the main Medical treatments, particularly in underdeveloped nations, for a variety of illnesses. The field of medicinal research known as "Herbal Medicinal Products" emerged as a result of the Astounding increase in the use of herbal plants and their extracts

The skin is the largest organ of the human body and acts as a protective barrier for internal organs while also serving as a sensory interface with the external environment. It is composed of three primary layers, namely the epidermis, dermis, and hypodermis, each contributing to overall skin function and homeostasis. The skin is continuously exposed to environmental factors such as microorganisms, pollutants, and ultraviolet radiation, making it vulnerable to various disorders including infections, allergies, and inflammatory conditions.

Since ancient times, medicinal plants have been widely used for the treatment and prevention of diseases. Different parts of plants such as leaves, roots, and stems possess therapeutic properties and have been utilized in traditional systems like Ayurveda. Despite the advancement of synthetic drugs, herbal formulations continue to be popular due to their safety, efficacy, affordability, and minimal side effects [3,4]

SOAP :

Soap is common cleansing agent well known to everyone. Many authors defined soap indifferent ways. Warra, 19 regarded it as any cleaning agent, manufactured in granules, bars, flakes, or liquid form obtained from by reacting salt of sodium or potassium of various fatty acids that are of natural origin (salt of non-volatile fatty acids).Soap can

also be said to be any water-soluble salt of fatty acids containing eight or more carbon atoms. Soaps are produced for varieties of purpose ranging from washing, bathing, medication etc.The cleansing action of the soap is due to the negative ions on the hydrocarbon chain attached to the carboxylic group of the fatty acids.

figure 1. Introduction of herbal soap

2. REVIEW OF LITERATURE :

1. **Jithendran** (2021) formulated and evaluated a polyherbal soap using neem, aloe vera, and turmeric through the cold process method. The study reported that the prepared soap exhibited good antimicrobial activity along with an acceptable pH, demonstrating the effectiveness of combining multiple herbal extracts.

2. **Vasudevan** et al. (2025) provided a comprehensive scientific review of herbal soaps, focusing on their composition, formulation techniques, and evaluation methods. The authors concluded that herbal soaps are safer, eco-friendly, and less likely to cause skin irritation compared to synthetic soaps, thus offering a strong theoretical basis for their formulation.

3. **Das et al.** (2024) developed herbal soap using the melt-and-pour method with various herbal extracts. Their findings showed good foamability, cleansing action, and skin compatibility, supporting the importance of evaluation parameters in herbal soap development.

4. **Chavan et al. (2025)** conducted research on polyherbal soap using the saponification method with neem, tulsi, and lemon oil. The study demonstrated superior antimicrobial and antioxidant properties, confirming the therapeutic value of polyherbal formulations.

5. **Mubassir et al. (2025)** reviewed the trends, benefits, and preparation methods of herbal soaps. Their study highlighted the shift from synthetic soaps to biodegradable and eco-friendly herbal formulations, emphasizing the evolution of herbal soap development.

6. **Patel and Shah (2022)** worked on the development and evaluation of herbal bath soap incorporating herbal oils. Their results indicated stable pH and good moisturizing effects, which are essential for formulation optimization.

7. **Kavitha et al. (2023)** formulated herbal soap using medicinal plants such as neem, turmeric, and sandalwood oil through the cold process method. The soap exhibited significant antimicrobial activity against Staphylococcus aureus, supporting the use of medicinal plants in soap formulation.

8. **Singh and Kumar (2020)** presented an overview of herbal cosmetics, stating that these products have higher consumer acceptability due to their natural origin and safety profile. This study established the growing importance of herbal cosmetics in the market.

3. NEED OF STUDY :

Soap is a mixture of sodium salts of naturally occurring fatty acids, produced by the process of saponification. When potassium salts are used instead of sodium, a softer soap is obtained. Although commercial soaps are widely available, many of them contain synthetic chemicals that may be harmful to the skin and can cause irritation, dryness, or allergic reactions.In recent years, there has been increasing interest in herbal and natural products due to their safety, effectiveness, and minimal side effects. Herbal soaps, prepared using natural herbs and plant-based ingredients, offer a better alternative to synthetic soaps. These soaps are enriched with bioactive compounds that possess therapeutic properties such as antibacterial, anti-inflammatory, antioxidant, and moisturizing effects.

The inclusion of ingredients like neem, aloe vera, turmeric, and essential oils enhances skin health by providing nourishment, protection, and healing benefits. Moreover, herbal soaps are environmentally friendly, biodegradable, and suitable for all skin types.

Therefore, the present study is necessary to formulate and evaluate herbal soap using natural ingredients, ensuring safety, efficacy, and improved skin compatibility while minimizing the harmful effects associated with chemical-based soaps.

4. AIM AND OBJECTIVES :

- To study traditional and modern methods of soap formulation
- To understand how herbal soaps were prepared historically versus current techniques.
- To compare traditional cold-process and hot-process methods with modern manufacturing methods.
- To identify and evaluate the active herbal ingredients used in soap
- To explore plants, essential oils, and natural extracts responsible for cleansing, moisturizing, and therapeutic properties.
- To assess their roles in providing antibacterial, anti-inflammatory, and antioxidant effects.
- To analyze the evolution of herbal soap formulations over time
- To trace changes in ingredients, preparation techniques, and market trends.
- To study the shift from purely natural formulations to stabilized and commercially viable herbal soaps.
- To assess the physicochemical properties of herbal soaps
- To evaluate parameters such as pH, formability, foam stability, appearance, and overall performance
- To evaluate antimicrobial activity of the formulated soap
- Trace changes in ingredients, production techniques, and market trends.
- Assess their role in skin benefits like antibacterial, anti-inflammatory, or antioxidant effects.

5. PLAN OF WORK :

Selection of Topic

The research topic (e.g., formulation and evaluation of herbal soap) is selected based on relevance and literature availability.

Literature Review

Collection and study of research papers, journals, and books related to herbal soap formulation and ingredients.

Procurement of Materials

All required chemicals and herbal ingredients (oils, extracts, sodium hydroxide, etc.) are collected.

Formulation Development

Preparation of herbal soap using suitable method (e.g., cold process method).

Optimization of Formulation

Adjusting ingredient ratios to obtain the best quality soap (texture, hardness, foam, etc.).

Evaluation of Product

Testing parameters such as:

pH

Formability

Hardness

Moisture content

Skin irritation test

Data Collection and Analysis

Recording observations and analyzing results using suitable methods.

Result Interpretation

Interpreting findings and comparing with standard values or previous studies.

Conclusion

Drawing final conclusions based on results obtained.

Report Writing and Documentation

Compilation of all sections (introduction, method, results, discussion, references

6. MATERIAL AND METHODOLOGY

Sr. No	Ingredients	Accurate weight	Role
1	Coconut oil	33 ml	Cleansing agent
2	Olive oil	28 ml	Moisturizer
3	Castor oil	11 ml	Foam booster
4	Sodium hydroxide	9 g	Saponifing agent
5	Distil water	25 ml	Solvent
6	Neemextract powder	2 g	Antimicrobial
7	Aloevera gel	5 g	Skin smoothing
8	Turmeric powder	1 g	Anti-inflammatory
9	Essential oil	1 ml	Fragrance

- **Cold process method :**

The cold process method is one of the most commonly used techniques for preparing herbal soaps. It involves the chemical reaction (saponification) between fats/oils and a strong alkali (usually sodium hydroxide) at relatively low temperatures without external heating.

The cold process method is highly suitable for herbal soap preparation because it maintains the bioactive phytochemicals of plant ingredients while ensuring effective cleansing through saponification. It is widely used in research and small-scale herbal product manufacturing.

The method is based on the saponification reaction, where triglycerides present in oils react with a strong alkali (NaOH/KOH) to form soap and glycerol.

The cold process method is a traditional and widely used technique in which soap is prepared without external heating, allowing the reaction to occur at ambient or mildly controlled temperatures. This method is especially preferred for herbal soap formulations because it preserves thermolabile phytoconstituents such as flavonoids, essential oils, and antioxidants

INGREDIENTS

1. Coconut Oil

Coconut oil is a natural oil obtained from the kernel of Cocos nucifera. It is widely used in cosmetic and pharmaceutical formulations due to its excellent moisturizing, cleansing, and antimicrobial properties.

Chemical Composition:

Coconut oil mainly contains:

Lauric acid (≈ 45–50%) – strong antimicrobial activity

Myristic acid – enhances cleansing property

Palmitic acid – provides hardness to soap

Caprylic & Capric acids – antifungal properties

Small amounts of vitamin E and antioxidants

Figure no.1 Coconut oil

2. Olive oil :

Olive oil is a natural oil extracted from the fruits of the olive tree, Olea europaea. It is widely used in pharmaceutical, cosmetic, and food industries due to its excellent moisturizing, antioxidant, and skin-protective properties

Source and Composition

Source: Fruit (olive)

Main constituents:

Oleic acid (55–83%)

Linoleic acid

Palmitic acid

Phenolic compounds (antioxidants)

Vitamin E (tocopherols)

Figure n.2 Olive oil

3. Castor oil:

Castor oil is a vegetable oil obtained from the seeds of the plant Ricinus communis. It is widely used in pharmaceutical and cosmetic formulations due to its unique chemical composition and excellent emollient and humectant properties.

Source and Composition

Source: Seeds (castor beans)

Main constituents:

Ricin oleic acid (85–90%)

Oleic acid

Linoleic acid

Stearic acid

Minor components: Vitamin E, sterols

Role in Herbal Soap Formulation

Castor oil plays an important role in soap making:

Produces rich and stable lather

Acts as a humectant (retains moisture in skin)

Improves soap hardness and texture

Enhances cleansing properties

Used in small amounts (usually 5–10%) to balance other oils

Advantages

Excellent moisturizing and conditioning effect

Enhances foam in soaps

Natural and biodegradable

Suitable for dry and sensitive skin

Figure no.3 Castrol oil

4. Sodium hydroxide:

Sodium hydroxide, commonly known as caustic soda or lye, is a strong alkali widely used in pharmaceutical, chemical, and cosmetic industries. In soap making, it is an essential ingredient for the process of Saponification, where it reacts with fats and oils to form soap and glycerine.

Chemical Information

Chemical name: Sodium hydroxide

Molecular formula: NaOH

Molecular weight: 40 g/mol

Role in Herbal Soap Formulation

Sodium hydroxide plays a critical role:

Acts as a saponifying agent

Converts oils and fats into soap and glycerine

Determines hardness and cleansing ability of soap

Essential for forming the final solid soap bar

Advantages

Highly effective and fast reaction

Produces firm and stable soap

Readily available and cost-effective

Figure no.4 Sodium Hydroxide

5. Distilled water:

Distilled water is purified water obtained by the process of Distillation, where water is boiled, vaporized, and then condensed to remove impurities, salts, and microorganisms. It is widely used in pharmaceutical and cosmetic formulations due to its high purity.

Role in Herbal Soap Formulation

Distilled water plays an important role:

Acts as a solvent for dissolving sodium hydroxide (NaOH)

Helps initiate the saponification process

Ensures uniform mixing of ingredients

Prevents unwanted reactions caused by impurities present in normal water

Advantages

High purity and free from contaminants

Improves stability and quality of formulations

Prevents microbial growth (initially)

Safe and non-toxic

Figure no.5 Sodium Hydroxide

6. Neem Extract Powder :

Neem extract powder is a herbal ingredient obtained from the leaves, bark, or seeds of the plant Azadirachta indica. It is widely used in cosmetic and pharmaceutical formulations due to its strong antimicrobial, antifungal, and skin-protective properties.

Chemical Constituents

Azadirachtin

Nimbin

Nimbidin

Flavonoids

Tannins

Essential oils

Role in Herbal Soap Formulation

Neem extract powder is highly beneficial in soap:

Provides antibacterial and antifungal activity

Helps in treating acne and skin infections

Acts as a natural cleansing agent

Improves therapeutic value of soap

Gives mild colour and herbal fragrance

Advantages

Natural and eco-friendly

Multi-functional (antimicrobial + anti-inflammatory)

Suitable for oily and acne-prone skin

Easily available and cost-effective

Figure no.6 Neem extract

7. Aloe vera gel:

Aloe vera gel is a natural mucilaginous substance obtained from the leaves of the plant Aloe barbadensis miller. It is widely used in cosmetic and pharmaceutical formulations due to its excellent moisturizing, soothing, and healing properties.

Chemical Constituents

Polysaccharides (acemannan)

Vitamins (A, C, E, B-complex)

Enzymes

Amino acids

Minerals (calcium, magnesium, zinc)

Anthraquinones (in small amounts)

Role in Herbal Soap Formulation

Aloe vera gel enhances soap quality by:

Providing deep moisturization

Giving soothing and cooling effect

Improving skin hydration

Enhancing smooth texture of soap

Supporting skin healing properties

Advantages

Natural and safe

Suitable for all skin types

Provides instant soothing effect

Enhances therapeutic value of formulations

Figure no.7 Aloe vera Gel

8. Turmeric powder

Turmeric powder is a natural herbal ingredient obtained from the dried rhizomes of the plant Curcuma longa. It is widely used in cosmetic and

pharmaceutical formulations due to its strong antimicrobial, anti-inflammatory, and antioxidant properties.

Chemical Constituents

Curcumin (main active component)

Demethoxycurcumin

Bisdemethoxycurcumin

Essential oils (turmerone)

Proteins and carbohydrates

Role in Herbal Soap Formulation

Turmeric powder enhances soap quality by:

Providing antibacterial and antiseptic properties

Helping in skin brightening

Acting as a natural colouring agent (yellow colour)

Improving skin health and glow

Supporting anti-acne activity

Advantages

Natural and safe

Multi-functional (colour + therapeutic effect)

Easily available and economical

Suitable for most skin types

Figure no.8 Turmeric powder

9. Essential oil:

Essential oils are concentrated, volatile aromatic compounds extracted from various parts of plants such as leaves, flowers, bark, roots, and fruits. They are widely used in cosmetic and pharmaceutical formulations for their fragrance as well as therapeutic properties.

Chemical Constituents

Terpenes (e.g., limonene, pinene)

Alcohols (e.g., linalool)

Aldehydes and ketones

Esters

Phenolic compounds

Role in Herbal Soap Formulation

Essential oils are important due to:

Providing pleasant fragrance

Offering antimicrobial properties

Enhancing therapeutic value of soap

Improving user appeal and sensory experience

Acting as natural preservative (mild) in some cases

Advantages

Natural and plant-derived

Multi-functional (fragrance + therapeutic effect)

Enhances product acceptability

Wide variety available

Figure no.9 Essential oil

7. PROCEDURE:

Weighing of Ingredients
(Coconut oil 30 g + Olive oil 25 g + Castor oil 10 g
NaOH 9 g + Distilled water 25 ml
Neem 2 g + Aloe vera 5 g + Turmeric 1-2 g + Tulsi 1-2 g + Curry leaves 1- 2 g)
↓
Preparation of Oil Phase
(Heat coconut oil, olive oil, and castor oil on water bath)
↓
Preparation of NaOH Solution
(Add 9 g NaOH into 25 ml distilled water, stir and allow to cool)
↓
Addition of Herbal Ingredients
(Add neem, aloe vera, turmeric, Tulsi, and curry leaves into oil mixture)
↓
Slow Addition of NaOH Solution
(Add cooled NaOH solution into oil mixture with continuous stirring)
↓
Continuous Stirring
↓
Addition of Fragrance (Optional)
↓
Pouring into Moulds
↓
Solidification
(Keep undisturbed for 24-48 hours)
↓
Removal from Moulds
↓
Cutting and Shaping
↓
Curing/drying
(Keep for 2-4 weeks)
↓
Final Herbal Soap Ready

8. EVALUATION TESTS

Evaluation of physicochemical parameters of the prepared formulation, various physicochemical parameters which are mentioned below were performed to establish the quality of the prepared formulations.

8.1 pH Test

Purpose:

To check whether the soap is acidic or alkaline.

Procedure:

Take 1 g of soap and dissolve in 10 ml of distilled water.

Stir well to make a solution.

Dip pH paper or use a pH meter.

Note the pH value.

Result:

Normal soap pH is 8 basic.

Figure no.10 pH Test of Herbal soap

8.2 Foam Test (Foaming Ability Test)

Purpose:

To check how much foam the soap produces.

Procedure (Foam Test Section)

1. Dissolve 1 g soap in 50 ml distilled water in a measuring cylinder.
2. Shake the cylinder 10 times vigorously.
3. Allow it to stand for 1 minute.
4. Measure the height of foam (cm) formed.

Result:

Height of the foam 2 cm this indicates good foaming ability.

Figure no.11 Foam Test of Herbal Soap

8.3 Moisture Content Test

Purpose:

To determine water present in soap.

Procedure:

1. Weigh about 5 g soap sample (W_1).
2. Dry it in a hot air oven at 105°C for 2 hours.
3. Cool in a desiccator and weigh again (W_2).

Calculation:

Moisture (%) = $(W_1 - W_2) \times 100$

Result:

10% moisture present

Calculation:

Moisture % = $(W_2 - W_3) / (W_2 - W_1) \times 100$

- Weight of empty dish (W_1) = 50 g
- Weight of dish + soap (W_2) = 60 g

8.4 Free Alkali Test

Purpose:

To check excess sodium hydroxide which can irritate skin.

Procedure:

1. Dissolve 2 g soap in 50 ml alcohol.
2. Add 2–3 drops phenolphthalein indicator.
3. Titrate with 0.1 N HCl until the pink colour disappears.

Result:

If no Pink colour appears – Free alkali is absent. (Good quality soap)

Figure no.12 Free Alkali Test of Herbal soap

9. RESULTS

The prepared herbal soap was evaluated using various physicochemical and performance parameters. The observed results are summarized below:

a) Physical Appearance

The formulated soap was found to be smooth, uniform, and free from cracks. It showed an acceptable color due to herbal ingredients like neem, turmeric, and aloe vera, and possessed a pleasant odor from essential oils.

b) pH Test

The pH of the soap was found to be in the range of 8–10, indicating a slightly alkaline nature suitable for skin application without causing irritation.

c) Foam Test (Foaming Ability)

The soap exhibited good foaming ability, producing stable and sufficient foam when agitated with water.

d) Foam Stability

The foam remained stable for a longer duration, indicating good cleansing efficiency.

e) Moisture Content

The moisture content was within acceptable limits, ensuring proper hardness and longer shelf life of the soap.

f) Hardness Test

The soap showed adequate hardness, indicating it would not break easily during handling and usage.

g) Cleansing Ability

The soap effectively removed dirt and oil from the skin, showing good cleansing action due to saponification of oils.

h) Skin Irritation Test

No signs of redness, itching, or irritation were observed, indicating the soap is safe and skin-friendly.

DISCUSSION

The herbal soap was successfully formulated using natural ingredients such as plant extracts, oils, and essential oils. The results obtained from evaluation tests confirm the quality and effectiveness of the prepared soap.

The pH range (8–10) is slightly alkaline, which is typical for soaps due to the presence of sodium salts of fatty acids. This range is considered safe for skin, although excessive alkalinity can cause dryness; however, the presence of moisturizing agents like aloe vera helps to balance this effect.

The foaming ability and foam stability were satisfactory, indicating that the soap has good surfactant properties, which help in effective cleansing. Natural oils such as coconut oil contribute significantly to foam production.

The hardness of the soap suggests proper formulation and curing, ensuring durability and longer usage. Moisture content being within limits prevents microbial growth and enhances shelf life.

The absence of skin irritation confirms that the herbal ingredients used (such as neem and turmeric) provide antimicrobial and soothing properties, making the soap suitable for regular use.

Overall, the formulated herbal soap demonstrated good physicochemical properties, stability, safety, and effectiveness, making it a suitable alternative to commercially available synthetic soaps.

Figure no.13- Soap in Mold.

Figure no.14- Removal of Soap from Mold.

CONCLUSION

The present study successfully focused on the formulation and evaluation of herbal soap using natural ingredients such as plant extracts, oils, and essential oils. The aim was to develop a soap that is safe, effective, and free from harmful synthetic chemicals.

The prepared herbal soap showed satisfactory physicochemical properties, including appropriate pH, good hardness, acceptable moisture content, and uniform appearance. The pH of the soap was found to be within the acceptable range (8–10), indicating its suitability for skin application without causing significant irritation.

The evaluation tests demonstrated that the soap possesses good foaming ability and foam stability, which are essential for effective cleansing. The presence of natural oils contributed to adequate

lather formation, while herbal ingredients enhanced the overall performance of the soap.

The cleansing ability of the formulated soap was found to be effective in removing dirt and oil from the skin. Additionally, the skin irritation test confirmed that the soap is non-irritant and safe for regular use, which highlights the advantage of using herbal ingredients over synthetic chemicals.

Furthermore, the herbal components such as neem, turmeric, and aloe vera provide additional therapeutic benefits, including antimicrobial, anti-inflammatory, and moisturizing properties. These properties make the herbal soap more beneficial compared to conventional soaps.

In conclusion, the formulated herbal soap can be considered a promising alternative to commercial synthetic soaps, as it is eco-friendly, skin-friendly, and cost-effective. The study also highlights the importance of using natural ingredients in cosmetic formulations to minimize adverse effects and promote healthy skin.

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