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Use of Rice Water in Cosmetology: A Review

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Abstract: ***Rice water, a traditional ingredient in Asian beauty rituals, has gained popularity globally for its potential benefits in cosmetology. Rice water is a byproduct of rice processing and can be considered a food processing wastewater. It contains a range of bioactive compounds, including antioxidants, vitamins, and minerals, which contribute to its high commercial value. The primary objective of this study is to review different formulations containing rice water along with an assessment of their safety, stability, and efficacy in cosmetic applications. In vitro studies have investigated the effects of rice water on skin and hair cells. Potential benefits of rice water are anti-inflammation activity, anti-aging properties, hair growth promotion, soothing and calming effects. The formulation containing 96% rice water demonstrated excellent biocompatibility, indicating its emerging benefits for use in cosmetics. In recent years, rice water has been widely accepted as a natural, cost-effective, and sustainable ingredient in skin and hair care formulations. Rice contents promote hair growth, improve hair texture, reduce dandruff, and protect hair from damage. Additionally, in case of skin care, it hydrates, moisturizes, reduces inflammation, and improves skin elasticity.***

Keywords: Rice water, anti-aging, skin care, rice by-product, hair growth, anti-oxidant, cosmetology.

I. INTRODUCTION

Rice is a key food staple, consumed by about half of the world's population [1]. It has been utilised for centuries in traditional medicine, cosmetic and skin care, hair care rituals, particularly in Asian culture [2]. Rice water extract, obtained by boiling rice, is a traditional source of starch and bioactive compounds with potential therapeutic and cosmetic applications. The extraction process involves the rinsing of fermented rice, which releases its soluble compounds into water. Rice water, derived by soaking or boiling rice, is frequently preserved but discarded during meal preparation, despite its significant nutritional and cosmeceutical potential. Rice water is commonly administered as a light, nutrient-rich gruel for patients recovering from illness due to its easy digestibility and soothing properties. It is especially effective in the treatment of diarrhoea such as gastroenteritis, food poisoning, and dysentery [3].

In recent times, rice water has been rich in vitamins B, C, and E, as well as essential minerals, which have been shown to provide numerous effective natural ingredients for skin and hair care. It can enhance skin cell growth and regeneration, skin hydration, and promote hair health. Plant fermentation is emerging as a significant trend in the cosmetic industry. Skin surface microecology and skin's natural physiological activities are being improved by fermented extracts made from natural botanicals and microbial cultures [4].

China remains the largest rice-producing country globally, with an estimated annual output of approximately 147.691 million metric tonnes [5].

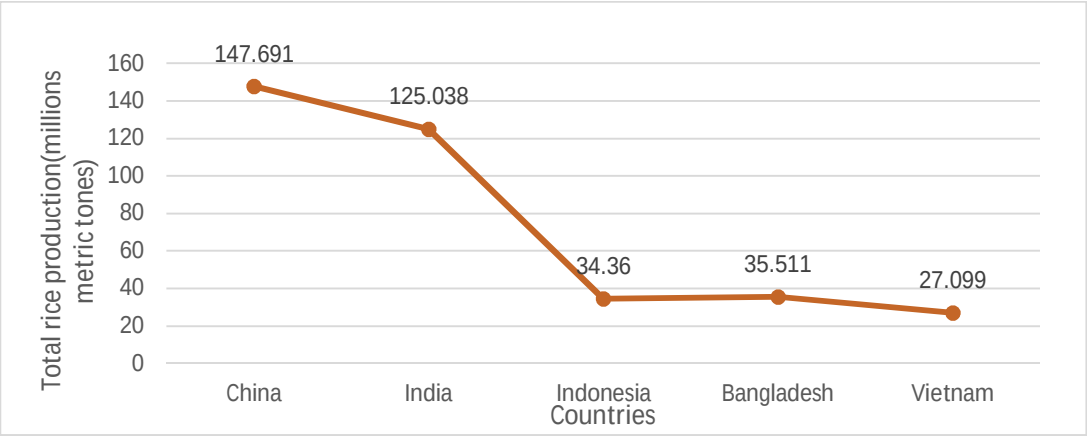


FIG. 1 Largest Exporter of Rice in the World

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- Biological Source: Rice (Oryza sativa) is a type of grass.
- Geographical Source: Rice is native to Asia (produces 87%). Now it is cultivated in many parts of the world, including China, India, Bangladesh, Vietnam, Indonesia, Korea, and Japan.
- Family: Poaceae (also known as Gramineae).
- Genus: Oryza
- Species: Oryza sativa (Asian rice) and Oryza glaberrima (African rice).

Rice water has become popular in the beauty industry as consumers seek out natural, safe, effective, and sustainable [6]. It exhibits the highest antioxidant activity and was selected for development into a hydrogel formulation. This offers an excellent vehicle for topical preparation due to its ability to facilitate controlled release of active ingredients. Fermented rice water is an ancient elixir that has been rediscovered for its remarkable beauty and wellness-enhancing properties. It is obtained through the process of fermentation and enhances the value of rice water [7]. The lack of standardized rice water formulations in cosmetics presents an opportunity to develop products that optimize their benefits and ensure broad compatibility with different skin and hair types.

Rice grains are rich in starch, which plays a critical role in both traditional and modern cosmetic applications. Starch has been recommended as an additive in bath water for the treatment of atopic dermatitis and other skin diseases, pruritus [8]. Starch is a naturally occurring biodegradable polymer that is widely acknowledged for its low toxicity and safety, making it appropriate for a variety of pharmaceutical applications. Utilizing modern delivery technologies such as microencapsulation or liposomal carriers can enhance the stability of rice water's bioactive compounds. These delivery technologies improve peneration into the skin’s and hair’s deeper layer and enables controlled release [9].

To create successful rice water-based products, manufacturers must be:

- Understand the inherent property of rice water.
- Ensure that the formulation is compatibility with complementary active and excipient substances.



FIG.2Rice Water: A Natural Solution

- Formulation to achieve targeted skin and hair benefits.

Rice and its derivatives possess multifunctional properties in skincare and haircare, owing to their rich content of bioactive compounds such as phenolic compounds, betaine, and squalene [10], which contribute to anti-aging [11], photoprotective [12], moisturizing [13], skin-brightening [14], and anti-inflammatory effects [15].

The hurdle is formulating stable, effective, and appealing products that can leverage the biologically active compounds of rice water while addressing modern skincare and haircare needs. This study aimed to formulate a series of rice water-based semi-solid preparations, including a skin toner to restore physiological pH, an herbal gel for lightweight moisturization, a herbal face pack with cleansing and revitalizing properties, a herbal shampoo to support scalp hygiene and hair health, and a hair mask designed to hydrate and strengthen damaged hair fibers.

Evaluate the biological effect (*in vitro studies)* of the formulated product on human skin, including its antioxidant, anti-inflammatory, and skin-protective properties, and also assess the sensory effect *(in vivo studies)*, including its texture, feel, and overall acceptability. A hydrogel formulation incorporating rice water was developed and evaluated for key pharmacotechnical parameters, including pH and viscosity. A 28-day study involving 12 volunteers assessed the biological and sensory effects of rice water gel, with safety evaluation conducted via the Human Repeat Insult Patch Test (HRIPT) protocol to determine potential skin irritation or allergic reactions. Despite its long history of traditional use, the cosmetics industry has not yet completely created standardized formulas that make advantage of rice water's therapeutic properties in contemporary skincare and haircare applications.

II. METHODS

There are three main methods to prepare rice water, depending on how you want to use it – whether for skincare, hair care, or even for plants.

A. Soaking Method (Quick and Easy)

Best for hair rinse, skin care, and plant nourishment. Steps: [16]

1) Half a cup of raw rice (white, brown, basmati, or jasmine) should be taken.
2) Rinse the rice thoroughly to remove dirt and excess starch.
3) The rice is soaked in 2-3 cups of clean water for approximately 30 minutes.
4) Strain the rice and collect the water.
5) Store the rice water in a sterile container; use immediately or refrigerate for up to seven days.



FIG. 3 Rice Soaking Method

B. Boiling Method (More Nutrient Rich)

This method extracts more nutrients from rice, making it beneficial for hair growth and plant fertilisers. Steps:

1) Take half a cup of rice.
2) Rinse the rice to remove impurities.
3) Put the rice in a pot with 2-3 cups of water.
4) Boil for 10–15 minutes until turbidity indicates starch release.
5) After the rice has cooled, strain it to remove the water.
6) Store in a clean, airtight container for up to a week.



FIG. 4 Boiling Method for Rice Water

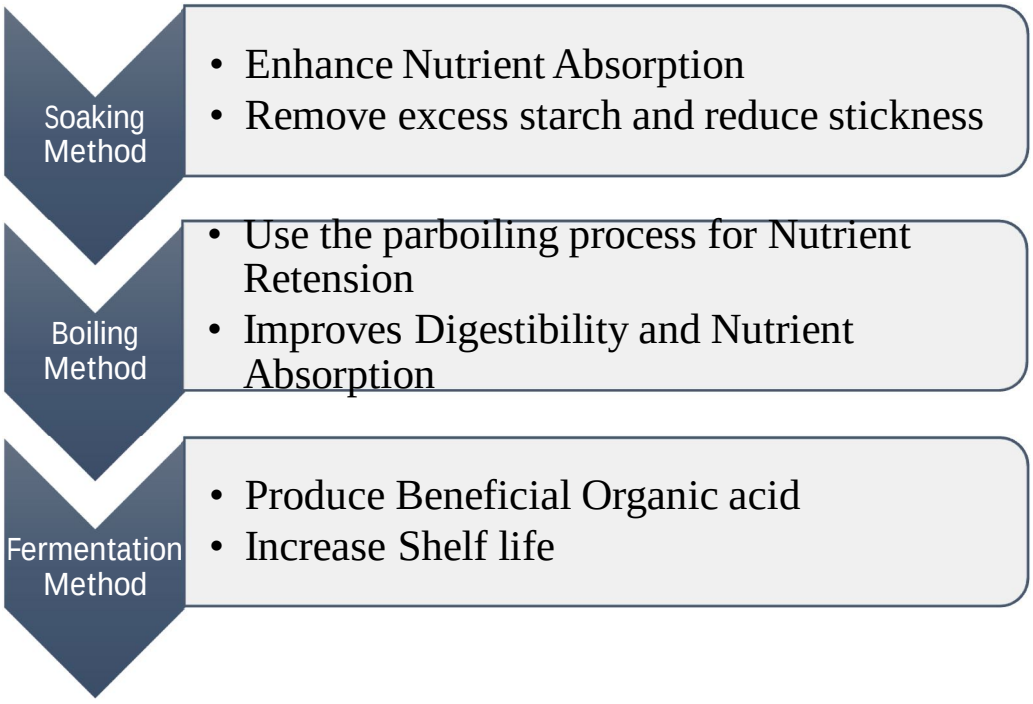
C. Fermented Rice Water (Rich in Pitera and Anti-oxidant):

Fermenting enhances the nutrient content, making it more effective for skin and hair. Steps:

1) Make the soaked rice water and let it sit at room temperature for 24 to 48 hours.
2) Once it turns slightly sour, refrigerate it to stop fermentation.
3) Dilute before use, as fermentation makes it potent.



FIG. 5 Fermented Rice Water Method



Benefits of Soaking, Boiling, and Fermentation Methods in Rice Water Preparation

TABLE 1: Natural Additives and Ingredients for Effective Rice Water Preparation [17]

INGREDIENTS	PROPERTIES	BENEFITS
CORE INGREDIENTS **1.** Rice	Organic rice is used to minimize pesticide exposure. Any type of rice can be used: white, brown, jasmine, basmati, or black rice.	• Rich in anti-oxidants • Prompting healthy hair growth • Softening and moisturizing
2. Water	Clean, distilled, or filtered water to prevent impurities and contaminants	• Hydration • Cleansing • Flushes toxins
OPTIONAL ADDITIVES A. Honey	Natural humectant that locks in moisture	• Hydrates dry skin and hair • Improves elasticity and shine
B. Aloe Vera Gel	Rich in vitamins A, E, and C, anti-inflammatory and antimicrobial	• Calming and moisturizing the skin • Alleviates dry scalp, itching, and irritation
C. Essential Oils ➢ Lavender Oil ➢ Tea Tree Oil ➢ Rosemary Oil ➢ Peppermint Oil	Calm the skin and scalp. Fights dandruff Stimulates hair growth It has a cooling effect and boosts blood circulation	• Adds therapeutic properties • Enhances the fragrance of rice water
D. Clay (Bentonite and Kaolin)	Detoxifies by drawing out impurities and excess oil	• Cleanse the scalp and skin deeply • Remove dirt and oil
E. Herbs and Botanicals ➢ Neem ➢ Rosemary ➢ Hibiscus ➢ Chamomile	Antibacterial and antifungal Improve scalp circulation Strengthens hair roots Soothes the skin and scalp	• Additional therapeutic properties • Boosts hair and skin health

III. RICE WATER

Rice (Oryza sativa) is a fundamental cereal crop worldwide, constituting a primary dietary staple for over half of the global population. Native to Asia, it has been cultivated for thousands of years, with major countries including China, India, Indonesia, Bangladesh, and Vietnam [18]. Rice water, the starchy liquid left after soaking or cooking rice, has been used for centuries as a natural remedy for skin and hair care [19]. It contains a variety of bioactive and biochemical compounds, including protein, triglyceride, lipid, starch, inositol, vitamin E and B, ferulic acid, minerals, and trace elements (magnesium, zinc, iron, calcium, selenium, and potassium). Historically, women in ancient Japan, particularly in the Heian period, used rice water to keep their hair long, strong, and shiny.

A. Rice Water Preparation [20]

1) Ingredients

- One cup of uncooked rice (white, brown, jasmine, or basmati rice can be used).
- Two to three cups of water (preferably filtered or distilled).

2) Method

a) Rince the Rice

- Place 1 cup of rice in a bowl.
- Rince the rice thoroughly under running water to remove dirt, dust, and any impurities.
- Swirl the rice gently with your fingers, ensuring the surface starch and any contaminants are washed away.

b) Soak the Rice

- Rinse and transfer rice to a sterile bowl.
- Add 2–3 cups of clean water.
- Soak for 30–60 minutes, stirring intermittently to facilitate the release of nutrients and starch.

c) Strain and Collect the Rice Water

- After soaking, strain to separate the aqueous extract.
- The collected liquid, characterized by its turbidity and high starch content, is known as rice water.
- Store in a sterile container for immediate use or allow fermentation to enhance bioactivity.

B. Bioactive Components

Rice water contains a variety of bioactive compounds that contribute to its beneficial effects on Cosmetology. These components include:

TABLE 2: Key Bioactive Components Present in Rice Water [16]

Sr. No.	COMPOSITION	FUNCTION	BENEFITS
1.	Protein (16%) Amino acid	Essential for cellular repair and regeneration Restoring damaged hair cuticles and enhancing skin elasticity	• Improving moisture retention • Repairs damaged hair
2.	Triglycerides (10%)	Effective emollients and conditioning agents	• Enhances scalp hydration and helps prevent dryness • Locks in moisture
3.	Lipid (10%)	Maintain the skin's natural barrier and support scalp health	• Enhances the skin lipid barrier • Reducing flakiness and irritation
4.	Starch (10%)	A film-forming agent, soothing, and anti-inflammatory. Widely used in Japanese Cosmetics	• Absorb excess sebum, ideal for oily skin and scalp • A smooth, for acne-prone and sensitive skin
5.	Inositol (Carbohydrate)	Penetrates the hair shaft and strengthens the hair from within	• Prevent hair breakage • Enhances hair texture and smooths the cuticle
6.	Vitamins B	Vitamin B: Boosts cell regeneration and promotes healthy skin care	• Enhance skin radiance • Prevents oxidative damage to hair follicles

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C. Technique for Preparing Rice Water

1) Rice Water by Boiling (RWB) [21]

- Method: 400g of whole paddy rice is boiled in 1 L of deionized water for 30 minutes.
- Processing: The water is then filtered using cotton gauze and frozen at 30°C until use.
- Effect: Boiling may extract more soluble nutrients quickly, such as starches and some vitamins, but some sensitive compounds may degrade with heat.

2) Rice Water from Whole Grains (RWM)

- Method: 400g of whole paddy rice is soaked in 1 L of deionized water and shaken for 24 hours at room temperature.
- Processing: The solution is filtered and frozen at 30°C.
- Effect: This cold extraction method preserves heat-sensitive nutrients and allows for the gentle release of minerals, vitamins, and antioxidants.

3) Rice Water from Crushed Grains (RWS)

- Method: 400g of paddy rice is crushed for 10 seconds in a household grinder to increase surface area, then soaked in 1L of deionized water and shaken for 24 hours at room temperature.
- Processing: Filtered and frozen at 30°C.
- Effect: Crushing increases the release of bioactive compounds, starches, and nutrients due to greater exposure of internal grain surfaces [22].

D. Cosmetic Application of Rice Water:

1) Hair Care: Inositol and amino acids in rice water strengthen and repair hair by penetrating damaged fibers, rebuilding the protein structure, enhancing shine and luster, and supporting hair growth through follicular nourishment [19].

2) Scalp Health: The hydrating properties of rice water help maintain scalp moisture balance, thereby preventing dryness and flakiness. Its mild astringent activity may assist in regulating sebum secretion and tightening scalp pores, potentially reducing the occurrence of dandruff.

3) Anti-Aging Properties: Rice water supports skin firmness and elasticity by inhibiting enzymes such as elastase that degrade structural proteins, thereby contributing to the preservation of a youthful skin appearance. [23].

4) Antioxidant Protection: The presence of vitamins A, C, and E, flavonoids, phenolic compounds, ferulic acid, and allantoin, which together help mitigate oxidative stress and attenuate visible signs of skin aging, such as fine lines and wrinkles, gives rice water significant antioxidant potential [24].

5) Skin Care: When applied topically, rice water helps to improve skin tone and texture by gently exfoliating dead cells. This leads to a smoother, even complexion. Antioxidant defence helps to protect skin cells from environmental stressors like pollution and UV exposure.

6) Sunburn Relief: Rice water has an anti-inflammatory property that helps to reduce the redness and soothe sunburned skin. Its cooling effect accelerates the healing process and discomfort associated with UV damage [25].

7) Anti-Frizz Property: Fermented rice water contains inositol, a carbohydrate-rich ingredient that offers an effective natural solution for achieving frizz-free, soft, and smooth hair [26].

8) Acne Treatment: Rice water's mild astringent property. Tighten pores and reduce excess oiliness, making it a gentle option for acne-prone skin. Its anti-inflammatory effects also help soothe acne-related irritation. [27]

9) Skin Brightening: Incorporating rice water into your skincare routine, whether as a toner or face mask, can help: Fade hyperpigmentation and dark spots and enhance skin radiance [28].

10) Boosts Skin barrier health: Rice starch plays a crucial role in maintaining and repairing the skin's natural barrier, preparing it to combat environmental aggressors and potentially preventing disorders like atopic dermatitis [29].

IV. FERMENTED RICE WATER

Fermentation is widely recognized as a powerful method for enhancing the nutritional profile of foods, and rice is no exception. The fermented rice has "probiotic" properties as well. Fermented rice contains lactic acid bacteria that break down the anti-nutritional elements in the grain, improving the bioavailability of minerals and micronutrients [30]. Fermentation has recently become an edge

method that greatly increases rice's bioactive potential and produces more potent cosmetic formulations. Its potential to improve skin barrier function, reduce oxidative stress, promote skin whitening, increase skin hydration, and address aging indications has been shown [31].

Fermented rice water has been traditionally recognized across diverse cultures for its multifaceted benefits in promoting health and enhancing aesthetic well-being. Rice water that has been allowed to naturally ferment, during which it becomes slightly sour. The fermentation process greatly improves the bioactive profile of rice water by adding more antioxidants, vital minerals, vitamins B and E, and *pitera*, a metabolite made by the yeast *Saccharomycopsis fibuligera* that has significant dermal benefits [32]. Pitera is known for its ability to support skin regeneration and is commonly found in high-end skincare products.

Fermented rice water contains phenolic compounds and flavonoids, powerful antioxidants that protect the skin and hair from oxidative stress caused by environmental factors like pollution and UV radiation [33].

A. Advantages of Fermented rice water

- Sustainability and Environmental Benefits
  Compared to conventional extraction methods, fermentation offers a number of ecological benefits. Because it uses less energy and water and produces less waste [34].
- Increased Production of Bioactive Compounds
  Significantly raised rice's bioactive phenolic and peptide contents, which improved its anti-inflammatory and antioxidant properties [35].
- Enhanced Biocompatibility and Bioavailability
  Alters the structural characteristics of polysaccharides by breaking them down into smaller, more absorbable forms, which increases their effectiveness and absorption [36].
- Improved Skin Tolerance and Reduced Irritation
  Skin's acid mantle is a thin, protective film that helps to maintain a healthy microbiome and defend against environmental aggressors [37].

B. Preparation and Fermentation of Rice Water

Step 1: Cooking and Cooling

- 150 gm of raw white rice was cooked in water for 30 minutes.
- Excess water was drained, and the cooked rice was allowed to cool at room temperature.

Step 2: Soaking and Fermentation

- 100 gm of cooked white rice was soaked in 500 ml of sterile water [rice: water (1:5)] in a container.
- The mixture was stored at room temperature and underwent overnight fermentation.

Step 3: Sampling and Characterisation

- Fermented rice water samples were collected at 0 hours and 24 hours.
- 50 mL of fermented rice water, measured at 0 and 24 hours of fermentation, was moved into different sterile containers for assessment at the quantitative and qualitative phenolic content analysis.

Step 4: Microorganism Isolation

- At 24-hour intervals, 2 ml of each fermented rice water sample were put into sterile Eppendorf tubes for microbe isolation.

C. Applications [38]

1) For Hair

- Frizz Control: Inositol contributes to frizz reduction by minimizing hair fiber friction, thereby improving texture, elasticity, and overall manageability.
- Natural Cleanser and Conditioner: Vitamin-rich with a scalp-friendly pH, fermented rice water acts as a natural conditioner.
- pH Balancing and Antioxidant Support: During fermentation, the pH level lowers, making it more compatible with the scalp and hair.
- Strengthens Hair and Delays Greying: Improves the damaged and aging hair but also helps delay premature greying, resulting in healthier, smoother, and shinier hair.

2) For skin

- Anti-aging Properties: Rich in antioxidants, which help to reduce signs of aging. Prevent wrinkles and improve skin elasticity.
- Sun Protection: Natural sunscreen properties and collagen-boosting effects keep the skin supple and firm.
- Dry Skin Relief: Helps soothe irritation caused by sodium lauryl sulfate (SLS). Using rice water twice a day can restore moisture to dry and damaged skin.
- Skin Lightening and Brightening: Potential to reduce dark patches and is commonly used in toners, soaps, creams, and even to even skin tone.

3) How to use fermented rice water: [38]

a) Hair Rinse

- How to do it: After shampooing and conditioning, pour fermented rice water slowly over your scalp and hair
- Massage: To increase circulation, gently massage for 2-3 minutes
- Leave-on time: 5-10 minutes.
- Rinse: Wash out thoroughly with lukewarm water
- Benefits: Nourishes strands, promotes scalp health, and adds shine and smoothness.

b) Hair Mask

- Mix: Combine 1\2 cup fermented rice water, 1-2 tablespoons of honey, coconut oil, or aloe vera gel.
- Apply: Distribute evenly from roots to ends.
- Leave-on time: 30-60 minutes.
- Rinse: Follow with your regular shampoo and conditioner.
- Benefits: Deeply hydrates, repairs damage, strengthens hair, and reduces breakage.

c) Facial Toner

- Preparation: cleanse your face, then saturate a cotton pad in fermented rice water.
- Apply: Swipe gently over face and neck, avoiding the eye area.
- Dry: Let your skin air-dry or lightly pat it with clean fingertips- no rinsing necessary.
- Benefits: Balances pH, soothes irritation, refines pores, and brightens skin tone.

d) Facial Mist

- Load: Pour fermented rice water into a spray bottle.
- Use: Mist evenly over face whenever skin feels tight or to set makeup.
- Benefits: Instantly refreshes, hydrates throughout the day, and helps maintain supplements.

e) Bath Additives

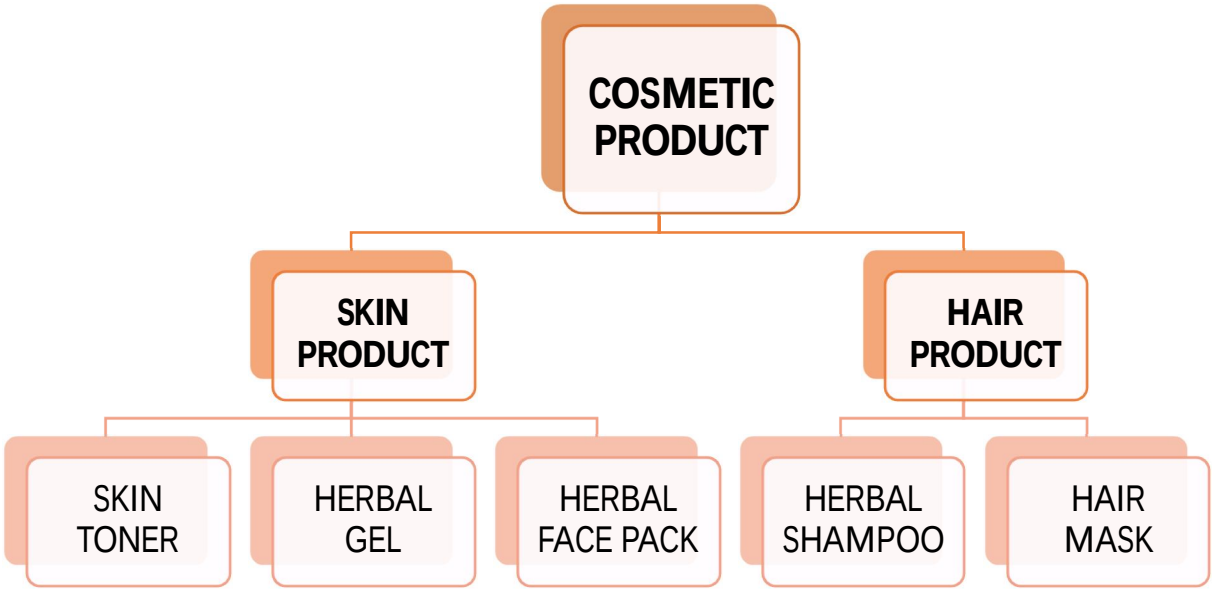
- Fill: Run your bath and add 1-2 cups of fermented rice water to the tub.
- Soak: Immerse and soak for 15-20 minutes.
- Pat dry: Gently towel-dry, need to rinse off the rice water residue
- Benefits: Softens and soothes skin, delivers full-body hydration, and leaves skin silky.



FIG. 6 Fermented Rice Water- The All-In-One Beauty Rin

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V. RICE WATER USED IN THE COSMETICS FIELD



A. Recent Examples in Skin Products by using Rice water

- ❖ Gallinee Face Recovery Mask: To clean, dry skin, which can be left on for 5-15 minutes before rinsing it off with lukewarm water.
- ➢ Ideal for soothing tired and dull skin, with brightening and hydrating properties.
- ➢ Anti-aging two-in-one property.
- ❖ April skin Artemisia Rice Essence Toner: Designed for oily and acne-prone skin.
- ➢ This light-weight toner combines rice bran extract with Artemisia extract, known for its anti-inflammatory and anti-bacterial properties.

B. Recent Examples in Hair Product by using Rice Water:

- ❖ Kitsch's Rice Water Shampoo and Conditioner:
- ➢ To promote hair growth, enhance shine, repair damaged follicles, and strengthen strands.
- ➢ It reduces hair shedding and breakage.

- ❖ Nykaa Naturals Fermented rice water Shampoo:
- ➢ To repair and nourish dry, damaged hair and enhance hair strength and texture.

VI. FOR SKIN

A. The Skin: Structure and Function

The largest organ in the human body, the skin contains 1.5 to 2.0 square meters of surface area on average and accounts for around 16% of the body weight [39]. It acts as a barrier against physical, chemical, and biological assailants, helps prevent excessive water loss, and plays a crucial role in thermoregulation [40].

The skin comprises three primary layers: [41]

1) Epidermis: The outermost layer is composed mostly of keratinocytes. It provides a waterproof barrier and is responsible for skin tone.

2) Dermis: Located beneath the epidermis, this layer contains connective tissue, blood vessels, nerve endings, hair follicles, and sweat glands.

3) Hypodermis (subcutaneous tissue): The innermost layer of the skin, primarily composed of adipose and connective tissue, functioning to provide insulation and mechanical protection to internal organs.

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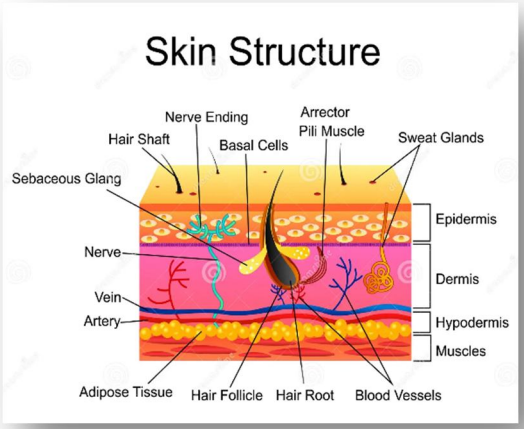


FIG.7 Structure of Skin

1) Functions of the Skin in Cosmetology

a) Protective Barrier

Cosmetic relevance: Effective moisturizers and barrier-repair creams (e.g., ceramide and lipid-rich formulation) restore barrier integrity after exfoliation or clinical procedures [42].

b) Sensory Interface

Cosmetic relevance: Product textures, message techniques, and device-based therapies (micronutrients, radiofrequency) leverage sensory feedback to enhance client comfort and perceived treatment efficacy.

c) Hydration and Homeostasis

Cosmetic relevance: Humectants (hyaluronic acid, glycerine) and occlusives (petroleum, silicones) are chosen based on their ability to reinforce NMFs and reduce TEWL -critical after invasive treatments to preserve barrier function and elasticity.

d) Absorption and Delivery

Cosmetic relevance: Formulation strategies (liposomes, nanoparticles) and pre-treatment exfoliation enhance permeability, allowing for efficient delivery of active ingredients in serums and masks [43].

TABLE 3: Summary of Dermatological Treatments and Their Mechanism

STUDY	SKIN PROBLEM	TREATMENT	MECHANISM
Augustin et al. [44]	Dry redness	Basic skin care products containing remoisturizing, lipid-replenishing, film-forming, skin-soothing, and antipruritic agents	Improves skin hydration, compensates for lipid deficiency, and enhances skin barrier function
Gollnick [45]	Acne	Combination therapy with topical retinoids and antimicrobials	Effectively eliminates *Pseudomonas acnes* and reduces the risk of antibiotic-resistant bacteria development.

Misery et al. [46]	Sensitive skin	➢ Restrictive use of cosmetics (avoiding irritants), protection from extreme environments, and daily sun protection ➢ Emollients/moisturizing	➢ Avoid aggravating factors ➢ Restores the damaged skin barrier.
Rabe et al. [47]	Sun damage / Photodamage	Sun protection (sun avoidance, sun-protective clothing, sunscreen)	Protects the skin from photodamage and UV-induced aging

2) Botanical Beauty: Rice Water's Role in Skin Formulation

1) Skin Toner: It is a fast-absorbing liquid used after cleansing to remove residual impurities, balance skin pH, tighten pores, and prepare the skin for better absorption of skincare products.
2) Herbal Gel: It is a semi-solid, transparent formulation enriched with natural plant-based ingredients like rice water and aloe vera, designed to treat skin concerns such as acne, wrinkles, and pigmentation while offering moisturizing and anti-aging benefits with minimal side effects.
3) Herbal Face Pack: It is a paste or cream-like formulation applied to the face to address specific skin concerns like dullness, acne, or aging, often using natural or herbal ingredients for therapeutic effects.

B. Skin Toner [48]

A skin toner is a quick-absorbing, light liquid that is used after cleansing to remove excess oil and makeup, revitalize the face, return its natural pH, and improve the skin's ability to absorb moisturizers or other treatments.
Toners have developed throughout time: [49]

- Traditional toners were primarily alcohol-based and designed to eliminate oil.
- Modern toners are more moisturizing, nourishing, and mild, often containing botanical extracts and humectants like glycerine or aloe vera.

1) Types of Toners

a) Epidermal Tighteners or Exfoliants: Mild toners aimed at tightening skin gently.
b) Botanical Remedies: Toners typically consist of water, humectants to attract moisture, and low concentrations of alcohol (up to 20%) to enhance astringency and cleansing efficacy.
c) Acid Toners: Stronger toners that include AHAs (Alpha Hydroxy Acids) or BHAs (Beta Hydroxy Acids). These are more effective options to exfoliate dead skin cells, unclog pores, and brighten the skin.
d) Astringent Toners: These toners are the strongest and contain a high concentration of alcohol (20-60%). They include antiseptics, water, and humectants. Often used for oily and acne-prone skin, but can cause dryness if overused [50].

2) Advantages of Toner

a) Remove Residual Impurities: Clears leftover makeup, oil, and dirt after cleansing.
b) Calm and Soothe Skin: Reduces redness, irritation, and inflammation.
c) Minimize Pore Appearance: Makes pores look smaller and tighter.
d) Encourages Moisture Retention: Assists in keeping the skin hydrated [51].
e) Balance Skin pH: Restore the skin's physiological pH (~5.5) following disruption by alkaline cleansing agents.
f) Deliver Active Ingredients: Prepares the skin to absorb serums, essences, and moisturizes better.
g) Improper Texture: Regular use results in a smoother, more refined skin surface.
h) Replenish Nutrients: Provides vitamins, antioxidants, and minerals to nourish the skin.

3) Disadvantages of Toner

a) Dryness: Alcohol-based toners can make the skin feel dry and fragile.
b) Potential Irritation: Excessive use might cause redness, stinging, or sensitivity.

c) Allergic Reaction: Some natural ingredients (like essential oils) may trigger allergies.
d) Flaky Skin: Particularly with over-application of strong astringents or rice water toners [52].
e) Unbalanced pH Levels: Incorrectly formulated toners may disrupt the skin's natural pH, causing irritation or acne.

TABLE 4: Quantity of Ingredients and their Role

Ingredient	Role	Quantity (50ml)
Rice Water	Anti-Oxidant Property	25 ml
Green Tea	Anti-Oxidant Property	14 ml
Aloe Vera	Anti-fungal Property	2 gm
Rose Water	astringent	9 ml
Essential Oil (Optional)	Anti-bacterial and Inflammatory Property	1-2drops
Grapefruit Seed Extract	Natural Preservative	2-5drops

4) Method of Preparation
a) Rinse the Rice: Rinse ½ cup of rice thoroughly under water to remove any contamination.
b) Soak the Rice: After cleaning, place the rice in a bowl with enough water to soak it for 2-3 hours, or until the water becomes cloudy. This indicates that the rice has released its nutrients into the water.
c) Strain the Rice Water: Swirl the rice gently in the water and strain the rice water into a clean bowl, ensuring the liquid is free from rice particles.
d) Add Ingredients: Aloe vera gel, green tea extract, and rose water are incorporated into the strained rice water to enhance its functional and dermatological properties. Optionally, add 1-2 drops of essential oil of your choice for fragrance or additional skincare benefits [53].
e) Blend or Stir: The mixture is gently blended or stirred to ensure uniform dispersion of all incorporated ingredients.
f) Fermentation (Optional): Allow the mixture to ferment for 12-24 hours to enhance its properties, as fermentation can increase the concentration of beneficial compounds [54].
g) Store the Mixture: The prepared mixture is stored in an airtight vessel, such as a spray bottle, to maintain stability and facilitate convenient application.
Store the final product in the refrigerator to maintain its freshness and extend its shelf life.

C. Herbal Gel
A gel is a semi-solid system where the movement of the liquid component (dispersing medium) is restricted by a three-dimensional network of particles or hydrated macromolecules from the dispersed phase [55]. These networks of polymers provide the gel formulation its rheological consistency and structural integrity. Gels are typically clear, transparent, semi-solid preparations that contain solubilized active ingredients for topical application [56]. A cost-effective, skin-friendly, and eco-conscious herbal gel has been developed using a fusion method, incorporating natural ingredients along with methanol and Tween 80 as functional excipients. This specific herbal gel formulation serves as a potent anti-aging agent, enriched with plant-based extracts.
It promotes skin firmness, reduces the visibility of fine lines, wrinkles, and enlarged pores, while effectively scavenging free radicals that contribute to premature skin aging [57]. In traditional Ayurvedic medicine, such herbal formulations are referred to as "Mocha Leaf" and are employed for the gentle and natural treatment of acne, blemishes, pigmentation, and scars.

1) Physical Characteristics
a) Appearance ranges from clear to translucent white.
b) Typically smooth, non-greasy, and easily spreadable
c) Polymer concentration: Usually between 0.5 to 2%, but can go up to 15% depending on formulation.

2) Classifications of Gels [58]
a) Hydrogels: A Gel in which water is the main dispersion medium (the liquid in which active ingredients are distributed).
b) Organogels: Gels in which an organic solvent (like oils or alcohol-based liquids) is the dispersion medium instead of water.

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3) Merits of Herbal Face Gel:

a) Antioxidant: Fights free radicals, preventing premature aging.
b) Deep Moisturization: Hydrates and nourishes the skin
c) Wrinkle Prevention: Helps maintain youthful skin by reducing fine lines
d) Antibacterial: Reduces acne-causing bacteria.
e) Dark Spot Reduction: Lightens pigmentation and evens skin tone
f) Sunburn Relief: Soothes and cools irritated skin

4) Demerits of Herbal Face Gel

a) Shorter Shelf Life: Despite being stable for 2 months, natural gels may have a shorter shelf life compared to synthetic formulations unless preserved well.
b) Limited Clinical Validation: The effects are based on traditional use and small-scale evaluation; large-scale clinical data may still be lacking.
c) Possible Allergenicity: Though natural, ingredients like honey or aloe vera may still cause allergic reactions in sensitive individuals.

Ingredients	Function	Quantity
Aloe Vera Gel	Soothes and hydrates skin	1 g
Rice Water Extract	Rich in starch, vitamins, and minerals, it helps in pore tightening and skin brightening	2.5 ml
Honey	Natural humectant with antibacterial properties	1 g
Tween 80	Non-ionic surfactant aiding in emulsification	1 ml
Methanol	Used as a solvent and preservative	5 ml
Distilled Water	Acts as a solvent base	Up to 25 ml

TABLE 5: Ingredient Profile and Quantitative Formulation of Herbal Gel

5) Formulation Procedure

a) Dispersion Phase: Weigh the required amount of gelling agent and disperse it in a small quantity of aloe vera juice to create a uniform mixture.
b) Addition Phase: Add the pre-weighed honey and Tween 80 into the aloe vera dispersion, mix until fully blended.
c) Preservative Phase: Methanol is gradually incorporated as a preservative and co-solvent to ensure homogeneity and extend formulation stability.
d) Final Adjustment: Methylparaben and propylparaben, pre-dissolved in a minimal amount of water, are incorporated into the formulation, and the final volume is adjusted to 25 mL with distilled water. [59]

6) Ideal Properties of Herbal Face Gel

a) Non-Irritating to Skin

- Proven through irritancy and patch tests
- Suitable for sensitive skin (non-hypersensitive)

b) Skin-Compliance pH

- The pH range of 5 to 7 is perfect for topical treatments because it closely matches the physiological pH of the skin.

c) Stable Over Time

- Remains physically and chemically stable for at least 2 months

d) Smooth Texture and Homogeneity
- Uniform and consistent texture
- Smooth feel confirmed by visual and tactile evaluation

e) Spreadability and Extrudability [60]
- Easy spread over the skin surface without dragging, for efficient coverage and penetration
- Smooth extrusion from tubes or pumps, ensuring consistent dosing and minimal waste.

f) Pleasant Organoleptic Properties
- Appearance: Smooth and white
- Odour: Pleasant fragrance
- Feel: Non-sticky, lightweight on skin

g) Anti-Acne and Anti-Aging Effects
- Formulated with natural agents like aloe vera, rice water, and honey
- Reduces pimples, scars, wrinkles, and dark spots

h) Barrier-Repair and Soothing Action
- Strengthens the skin's protection against environmental aggressors by promoting the regeneration of the skin barrier, especially through rice starch or its hydrolysates.

D. Herbal Face Pack

Face packs consist of powder-based skincare formulations that are applied as a paste or solution and dry to leave a film on the face. This film offers a tightening, strengthening, and cleansing effect. Herbal face packs help cleanse, promote skin fairness, nourish, and rejuvenate the skin, improving overall complexion. When the applied face pack is removed, it also eliminates skin debris and accumulated dirt [62]. Herbal cosmetics have gained immense popularity for their natural origin, biocompatibility, minimal side effects, and proven effectiveness rooted in traditional practices [63].

Face packs are among the oldest and most effective methods for cleansing the skin. In Ayurvedic literature describes various types of face packs endowed with nourishing, healing, cleansing, astringent, and antiseptic properties [64]. They are cost-effective, natural, and generally free from harmful side effects. The rising popularity of herbal face packs can be attributed to their wide range of therapeutic properties, such as anti-inflammatory, antimicrobial, antioxidant, and soothing effects, which contribute to healthier and more radiant skin [65].

1) Benefits of Applying Face Packs: [66,67]

a) Reduces Acne and Scares: Helps diminish acne, pimples, scars, and marks depending on the herbal ingredients used.
b) Removes Dead Skin Cells: Exfoliates and eliminates dead skin cells, promoting skin renewal.
c) Provides a Soothing Effect: Offers a calming and relaxing sensation to the skin.
d) Enhances Glow and Complexion: Regular use improves skin texture, brightness, and radiance.
e) Protects Against Environmental Damage: Combat the harmful effects of pollution and harsh weather, shielding the skin from environmental stressors.
f) Prevents Premature Aging: Slows down early signs of aging through the action of natural antioxidants.
g) Reduces Wrinkles and Fine Lines: Helps minimize the appearance of wrinkles, fine lines, and skin sagging.
h) Promotes Youthful Skin: Leaves the skin looking healthier, younger, and more vibrant.
i) Oil Control and Skin Cleansing: Absorbs excess oil, leaving the skin fresh, clean, and matte.
j) Minimizes Pores: Refines large pores, giving the skin a smoother and more even appearance.

2) Disadvantages of Face Pack

a) Temporary Effects: The benefits are often short-lived and require regular use for sustained results.
b) Overuse Can Damage Skin: Using face packs too frequently can strip natural oils and disrupt the skin barrier.

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c) Long Drying Time Can be Irritating: Some face packs take a long time to dry, which may cause discomfort or irritation during use.
d) Challenging for Dry Skin: Applying face packs can be particularly difficult for individuals with dry skin, as certain ingredients may further dehydrate or irritate the skin [68].

3) Important Precautions When Using Face Pack:
a) Choose According to Skin Type: Always select a face pack that suits your specific skin type. It's advisable to consult a natural therapist or a qualified skin expert before application [69].
b) Limit Application Time: Face packs should be removed within 15–20 minutes, as extended application may lead to adverse effects such as wrinkles, sagging, or enlarged pores.
c) Avoid the Eye Area: The skin around the eyes is extremely delicate, and applying face packs in this area may irritate it. Additionally, removing the pack can stress or damage the sensitive skin, so it's best to avoid this region entirely.
d) Avoid Vigorous Scrubbing: Scrubbing the face too harshly can irritate the skin, leading to breakouts, pimples, and the formation of dark spots [70].
e) Post-Face Pack Care: Before removing a dried face pack, gently spray room-temperature water onto your face to soften the mask. After removal, glide a cool ice cube across your skin. This helps tighten the skin, close open pores, and provide a soothing, toning effect.

4) Materials and Methodology of Herbal Face Pack
a) Material used: [71]
- Rice Water - Rich in antioxidants, anti-aging, pore-tightening, brightening, and soothing properties
- Gram Flour (Besan) – Acts as a gentle exfoliant, removes tan and impurities, and tightens skin
- Honey – Natural humectant; moisturizes, heals acne, and adds glow
- Curd (Yogurt) – Provides naturally derived lactic acid with mild exfoliating and skin-brightening properties.
- Mashed Banana – Hydrates, softens skin, and provides vitamins A, B, and E
- Castor Oil – Moisturizing and skin-smoothing properties, along with notable anti-inflammatory activity
- Cocoa Butter – Rich in fatty acids, improves elasticity, deeply nourishes dry skin

b) Ideal Characteristics of Face Packs:
- Non-irritating and Non-toxic: It should be safe for regular use on all skin types without causing allergic reactions, rashes, or discomfort.
- Physically and Chemically Stable: The formulation should maintain its texture, color, and efficacy over time under normal storage conditions.
- Free from Gritty Particles: To ensure smooth application and user comfort, the pack should have a fine, uniform consistency without abrasive particles.
- Pleasant Odour: A naturally pleasing fragrance enhances user experience and indicates the freshness of herbal ingredients.

TABLE 6: Formulation of Face Packs from Rice Water [72]

Face Pack Type	Ingredients	Purpose	Application Instructions
Anti-Tan and Detoxifying Pack	2 tbsp rice water, 1 tbsp gram flour, 1 tsp honey	Helps reduce tanning and removes environmental impurities	Apply for 20 mins; rinse with lukewarm water and pat dry
Probiotic Firming Face Pack	½ cup curd, 2 tsp rice water	Anti-aging, skin firming (probiotic mask)	Let sit 10 mins, apply for 10 mins; wipe with wet cloth
Revitalizing Banana-Rice Mask	½ cup rice water, ½ mashed banana, a few drops of castor oil	Revives tired, dull skin	Apply under the eyes; remove gently with soaked cotton
Antioxidant Cocoa Scrub	1 tbsp rice water, 2 tsp cocoa powder	Antioxidant scrub to enhance skin radiance	Gently massage in upward circular motions; rinse thoroughly and pat dry

5) Methodology

a) Selection of Ingredients:

- Natural, skin-beneficial materials such as rice water, gram flour, honey, curd, mashed banana, castor oil, and cocoa butter are chosen based on their roles.

b) Preparation of Rice Water:

- Boiling Method: Rice is boiled with distilled water. After cooking, the water is strained and collected.
- Rice water contains a diverse array of antioxidants, vitamins, and minerals that support skin revitalization and enhance complexion brightness.

c) Mixing of Ingredients:

- Specific combinations are made depending on the intended skin benefit:
  - Anti-tan Pack: 2 tbsp rice water + 1 tbsp gram flour + 1 tsp honey.
  - Anti-aging Pack: ½ cup curd + 2 tsp rice water (probiotic mask).
  - Revitalizing Pack: ½ cup rice water + ½ mashed banana + a few drops of castor oil.
  - Antioxidant Scrub: 2 tsp cocoa powder + 1 tbsp rice water.

d) Blending:

- The components are uniformly mixed to form a consistent, smooth-textured paste free from grittiness.

e) Application:

- The prepared face pack is applied evenly on the face and neck.
- It is left on for 10–20 minutes, depending on the formulation.
- Removed using lukewarm water or a damp cotton cloth.

f) Storage and Use:

- Since the pack is free from preservatives, fresh preparation is recommended every 2–3 days.
- Store in a clean, airtight container in the refrigerator if needed temporarily.

V. FOR HAIR

Human hair is primarily made up of protein, with approximately 65-95% of its weight consisting of keratin, a fibrous, sulfur-rich protein that provides the hair with strength, flexibility, and resilience [74]. Human hair also contains lipids, color, trace minerals, and water (about 30%) in addition to keratin. Together, these constituents enhance the structural integrity, functionality, and durability of the hair. Keratin gives hair its strong qualities by forming a complex, layered structure. The structure and order of these proteins also greatly influence the physical attributes of hair, including its texture and form. The structure of the hair follicles has a major role in determining the shape of hair; smaller follicles generate finer, "villus" hairs (like those on the body), while larger follicles make thicker, "terminal" hairs (like those on the scalp) [75]. Whether hair is curly, wavy, or straight is also determined by the curvature of the hair follicles.

A. Structure of Hair

1) Hair shaft and root
2) Hair follicle and muscle attachment
3) Hair bulb and papilla
4) Hair growth process
5) Color determination

B. Hair Products Formed with the help of Rice Water

1) Hair Shampoo: Herbal shampoo is a cosmetic product made from traditional Ayurvedic herbs used to cleanse the hair and scalp without stripping away essential oils.
2) Hair Mask: A hair mask is a deep conditioning treatment designed to nourish, repair, and strengthen hair by addressing issues like dryness, breakage, and dullness.

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C. Hair Shampoo

Herbal shampoos are topical cleansing formulations comprising traditional Ayurvedic herbs, intended to maintain scalp hygiene and promote hair health [75]. A substance used for hair washing; shampoo is a viscous liquid. Shampoo aims to remove undesirable buildup between hairs, limit hair loss, and remove filth without eliminating too much sebum, which makes managing hair tough. Shampooing is the most popular hair treatment. Herbs and their extracts can be used to make soap available today, which is surfactant-based. Although surfactants are included for their cleaning properties, long-term use of them can damage hair, irritate the eyes, and cause hair loss and dryness.[76]

Need for Shampoo: [77]

- The scalp produces a lipid-rich substance known as sebum, which functions to lubricate the hair and protect it from dehydration and environmental damage.
- This gives hair a healthy shine.
- Eliminate extra oil.

Function of Shampoo: [78]

- It must effectively and thoroughly remove dirt.
- The hair must be thoroughly cleaned.
- The dirt should be easily removed by rinsing with water.

Advantages of Shampoo: [79]

- Cheaper and easier to produce.
- Used herbal resources are pure and organic.

Disadvantages of Shampoo: [80]

- Masking the inherent odor and taste can present formulation challenges.
- The manufacturing process is laborious and complex.

Types of Shampoo:

Shampoo is of the following type

1. Based on function
2. Specialized shampoo

D. Preparation of Herbal Shampoo [81]

1) Prepare Fermented Rice Water: Soak washed rice in distilled water (1:2 ratio) for 24-48 hours at room temperature. Strain and keep the liquid.
2) Prepare Herbal Extract: Boil dried Shikakai, Reetha, and Amla powder separately or together in water, cool, strain, and filter.
3) Prepare The Base: Mix fermented rice water with Aloe Vera gel and Glycerin.
4) Add Herbal Extract: Incorporate Shikakai, Reetha, and Amla extracts slowly into the base with continuous stirring.
5) Thicken The Shampoo: Disperse xanthan gum in a small amount of water, then slowly add to the mixture to achieve the desired viscosity.
6) Add Active Ingredient: Add essential oil and vitamin E under gentle stirring.
7) Preserve and Finalize: Add potassium Sorbate if a longer shelf life is required (for up to 3-6 months). Maintain a pH of 5.0–5.5 to support healthy hair and scalp conditions.
8) Packaging: A Bottle of shampoo is sterilized and packaged in an airtight container.

Store away from direct sunlight.

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INGREDIENT	PRCENTAGE (%)	FUNCTION
Fermented rice water	50%	Nourishes hair
Aloe Vera gel	10%	Moisturizer and scalp smoother
Shikakai Extract	8%	Natural cleansing agent
Reetha Extract	8%	Natural cleansing and foaming
Amla Extract	5%	Strengthens and conditions hair
Xanthan Gum	0.5%	Thickening agent
Glycerin	5%	Humectant
Essential oil	0.5%	Fragrance, scalp stimulation
Vitamin E	0.5%	Antioxidant, mild preservation
Potassium Sorbate	0.5%	Extended shelf life
Distilled Water	100%	Adjust Volume

TABLE 7: Formulation of Fermented Rice Water Herbal Sampoo [82]

E. Ideal Properties of Herbal Shampoo

1) Natural Cleansing Ability: Should effectively cleanse the scalp and hair without harsh chemicals.
2) pH Balanced: Ideally pH 4.5-5.5 to match the scalp, preserving natural oil.
3) Nourishing: Rice water contains abundant amino acids, along with vitamins B and E and essential minerals, which collectively support hair repair and reinforcement.
4) Moisturizing: Ensures adequate hydration of the scalp and hair, helping to prevent dryness and structural hair damage.
5) Non-toxic and Biodegradable: Free from sulfates, parabens, and synthetic fragrances.
6) Stability and Shelf life: Should remain effective and safe over time without synthetic preservatives.

VI. HAIR MASK

Hair masks stand out among the many hair care treatments meant to encourage strong, glossy hair because of their potent reparative properties. They revitalize lifeless hair by addressing typical issues like frizz, breakage, dryness, and dullness [83]. They are made to provide concentrated nutrients. For millennia, societies all over the world have utilized hair masks, combining different products and methods to enhance the health and appearance of hair. Deep conditioning treatments have changed throughout time to accommodate a wide range of client demands, from traditional cures to contemporary advancements [84]. A carefully chosen combination of substances that are known to strengthen, heal, and revive the hair and scalp is the foundation of any successful hair mask [85].

A. Advantages of Hair Mask: [86]

1) Deep conditioning: Replenishes moisture and nutrients to improve softness and manageability of dry or damaged hair.
2) Improve Hair Strength: Helps reduce breakage and split ends.
3) Restores Shine and Softness: Makes hair smoother and shinier.
4) Scalp Health: Helps reduce dandruff and itchiness.

B. Disadvantages of Hair Mask: [86]

1) Time Consuming: Often requires leaving for 10-13 minutes, which might not suit busy routines.
2) Can Weigh Hair Down: If used too frequently or on fine hair, it may cause limpness.
3) Build Up Risk: Regular use without rinsing can lead to residue buildup on the scalp.
4) Cost: Very expensive compared to others.

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TABLE 8: Formulation Ingredients of Hair Mask [87]

INGREDIENT	FUNCTION	PERCENTAGE(%w/w)
Fermented Rice Water	Strengthen hair, rich in inositol and amino acids	70%
Aloe Vera Gel	Moisturizes and soothes the scalp	10%
Coconut Oil	Deep conditioning reduces protein loss	8%
Milk Protein	Nourishes hair; adds shine	5%
Vitamin E Oil	Antioxidant: promotes scalp health	2%
Rosemary Essential Oil	Stimulates hair growth; improves circulation	1%
Rose Water	Hydrates and adds fragrance	4%

C. Preparation of Hair Mask

1) Prepare the Base Mixture: Milk protein is incorporated into fermented rice water and stirred in a medium-sized container until evenly blended [88].

2) Blend the Oils: Coconut oil, rosemary oil, and vitamin E oil are mixed in a separate container until a consistent blend is achieved.

3) Create the Hydrating Solution: Rose water and aloe vera gel are blended in a separate container until a smooth, homogeneous consistency is obtained.

4) Combine All Mixtures: In a large container, combine the base mixture, blended oils, and hydrating solution. Mix thoroughly until all components are fully integrated into a smooth, consistent treatment.

D. Ideal Properties of Hair Mask [89]

1) Hydration: Deeply nourishes and moisturizes to prevent dryness and breakage. Perfect for dry or damaged hair.

2) Strengthening: Fortify strands with natural proteins like rice water and milk protein for healthier, stronger hair.

3) Restoration: Repair split ends and revive tired tresses with ingredients like rose water.

4) Soothing: Calm your scalp with aloe vera and relive irritation naturally.

5) Purification: Say God to build up! Detox your scalp and promote a fresh, clean feel.

6) Boosting shine: Add a radiant glow to your hair and bring back its natural lustre!

VII. CONCLUSION

Rice water has gained significant attention in cosmetology due to its rich content of vitamins, minerals, amino acids, and antioxidants. It has been traditionally used in various cultures for enhancing skin and hair health and is now supported by modern studies for its beneficial effects. In cosmetics, rice water serves as a natural, affordable, and effective ingredient for skin care and hair care.

Its natural composition makes it suitable for various formulations like shampoos, conditioners, face packs, toners, and hair masks. Furthermore, it is generally safe, non-toxic, well-tolerated, and eco-friendly. It offers a perfect blend of purity, tradition, and innovation in modern cosmetology.

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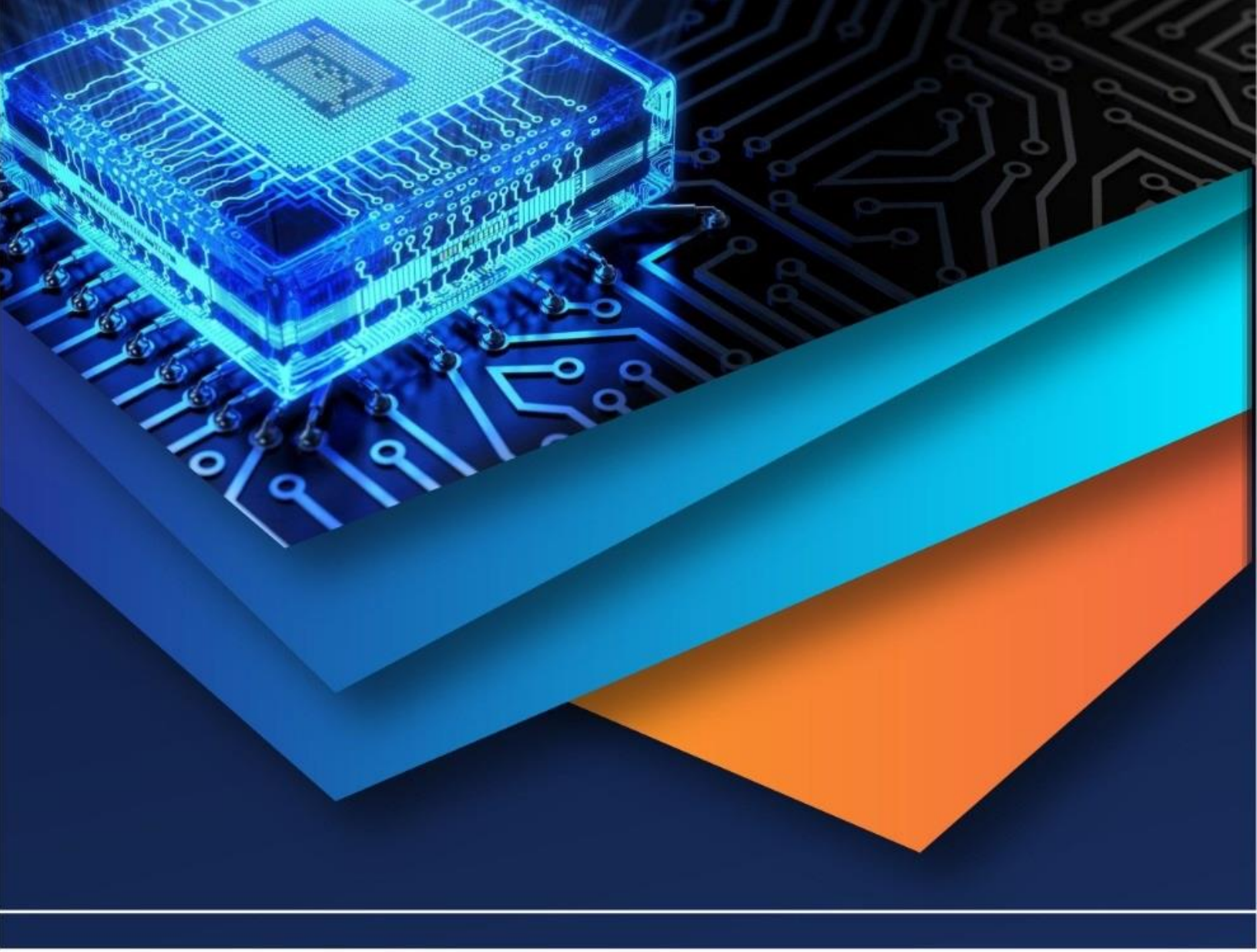
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