



MULTIPURPOSE INGREDIENT FOR COSMETICS: RICE (*Oryza Sativa*)

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Abstract: Rice is the cuticle that exists between the rice and the husk of the paddy and is made up of the embryo and endosperm of *Oryza sativa* (family *Gramineae*) seeds. Rice bran is a natural component of whole grains and contains phytonutrients such as oryzanols, tocopherols, tocotrienols, phytosterols, and, most significantly, dietary fibres. Rice bran oil is extracted from rice bran, which is a waste product of the rice milling industry. Rice bran wax is a natural vegetable wax produced by rice bran oil refineries as a value-added by-product. Rice Bran Fatty Acid, which is obtained from crude Rice Bran oil, is believed to be the most widely available product. Rice water that has been fermented and turned slightly sour is known as fermented rice water. Rice has many cosmetic applications in skin care and hair care. The primary goal of this article is to educate readers about rice, including its different parts, extraction methods, and cosmetic applications.

Keywords: Rice (*Oryza Sativa*); rice bran; rice bran oil; rice bran fatty acid; rice bran wax; fermented rice water; cosmetic; applications.

INTRODUCTION

Rice is Asia's most significant cereal, and it is a staple diet for the vast majority of the region's people. Women in Japan during the Heian period (794-1185 CE) wore floor-length hair. They washed with rice water to keep their hair healthy (Yu-Su-Ru). China has a contemporary version of this story. The Yao women of Huangluo, China, are known for their long hair, with averages 6 feet in length. Another reason Yao women use rice water for their hair is that their hair doesn't lose its color until they are far into their eighties or beyond. Rice bran oil has long been applied in the cosmetic industries due to its high level of antioxidant-rich components such as ferulic acid, gamma-oryzanol, and phytic acid¹ as well as the treatment of skin problems.² Rice bran oil and rice bran extracts were employed in their natural state and nano encapsulated for UVB protection^{3,4} and for the treatment of skin diseases.^{5,6} Rice bran bioactive chemicals have also been discovered to have anti-aging properties.^{7,8} and to be effective in the treatment of alopecia.⁹ In the last years, the search for new bioactive compounds to prevent skin aging has increased. In parallel, there is an increasing concern regarding products from natural origin, if possible, from organic farming in cosmetic products. Rice water is a natural, economic and simple ingredient that can be incorporated into skincare products. It can be obtained from different types of rice present in the human diet and also from rice residues resulting from the rice industry, as a way to transform it into an added-value product.¹⁰

Biological Source:

Rice is the seed of grass species belonging to genus *Oryza*. *Oryza sativa* (Asian rice) and *Oryza glaberrima* are the two species (African rice). *Oryza sativa* is the most widely grown species worldwide while *Oryza glaberrima* is only grown in South Africa.¹¹

Geographical Source:

China, India, Indonesia, Bangladesh, Vietnam, Thailand, Myanmar, Pakistan, the Philippines, Korea, and Japan now produce the majority of the world's rice. Despite this, Asian farmers still produce 87% of the world's rice.¹²

Morphology of Rice Plant:

It is one of the world's three major food crops, and it is the staple diet of about half of the world's population. Rice output in the world is predicted to reach 650 million tonnes, with a total area under rice cultivation of 156 million hectares. Asia is the world's leading producer of rice, accounting for around 90% of global output. Rice is extremely important to Asia's food security because over 75% of the supply is consumed by people in Asian countries.¹³

Table no.1 Taxonomy ¹



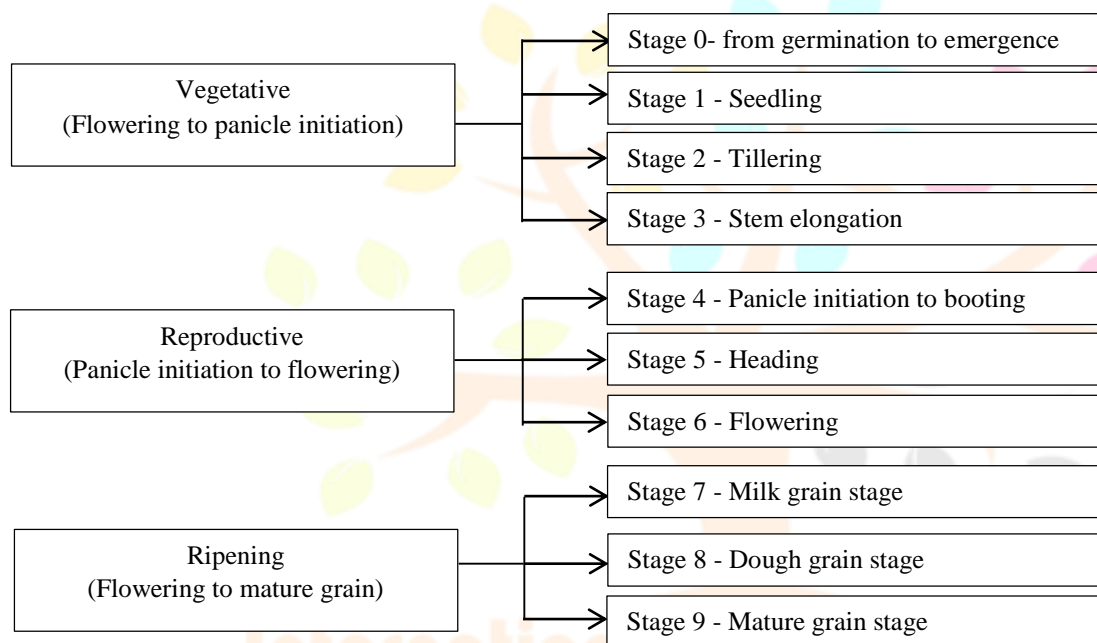
Figure no.1 Rice Plant

Name	Rice
Kingdom	Plantae
Division	Magnoliophyte
Class	Liliopsida
Order	Poales
Family	<i>Gramineae (Poaceae)</i>
Tribe	oryzeae
Genus	<i>Oryza</i>
Species	<i>sativa</i>

Growth and development stages of rice

The ten stages of rice development will be grouped in three larger phases:

The vegetative phase covers the amount from germination to panicle initiation, the reproductive phase covers the amount from panicle initiation to flowering and the ripening phase covers the amount from flowering to finish maturity.¹⁴



Flow Chart 1: Growth and Development Stages of Rice

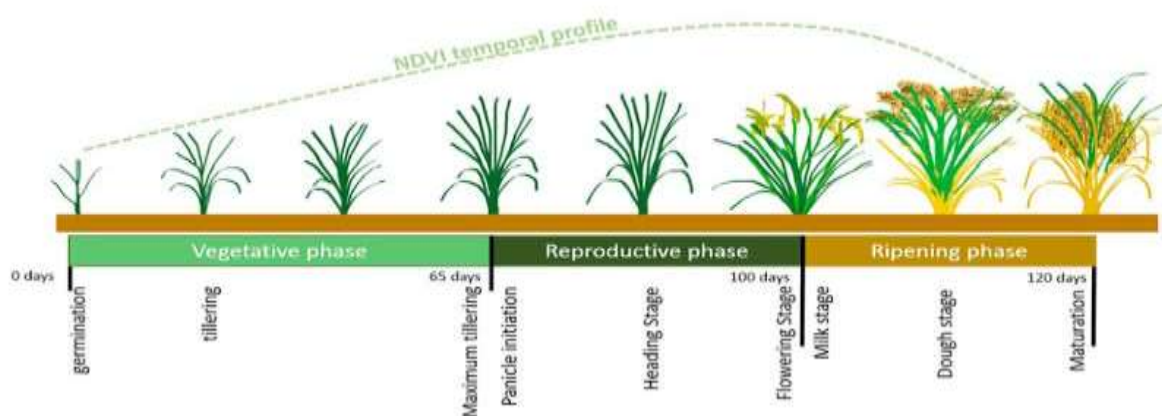


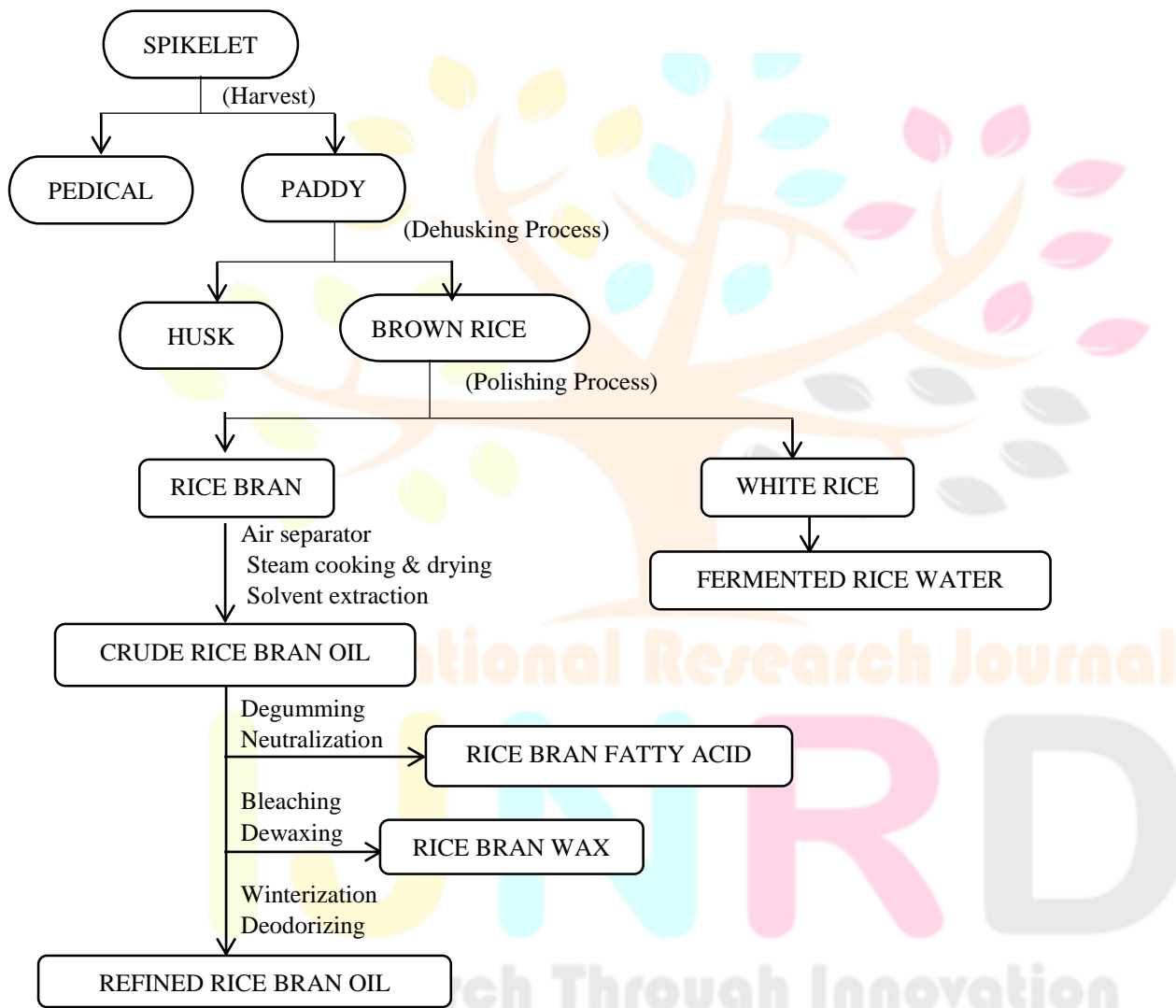
Figure No.2 Growth and Development stages of Rice

Chemical constituents:

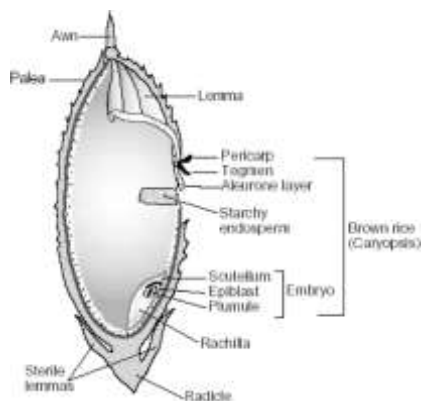
Rice is rich in carbohydrate, has a moderate amount of protein and fat, and is high in vitamin B complex vitamins like thiamin, riboflavin, and niacin (Fresco, 2005). Starch, made up of amylose and amylopectin, is the major carbohydrate in rice. The rice grain is made up of 12 % water, 75–80 % carbohydrate, and just 7% protein containing all of the essential amino acids. It has high biological value (74%) and protein efficiency ratio (2.02–2.04%) due to the presence of a greater lysine concentration (about 4%). Calcium, magnesium, and phosphorus, as well as traces of iron, copper, zinc, and manganese, are present. Rice is considered as the queen of cereals due to its nutritious value and ease of digestion. Starch, glucose, sucrose, and dextrin make up around 80% of the carbohydrate in freshly harvested rice grains.¹⁵

Table no. 2 Physicochemical Characterization of Rice¹⁶

Determination	Rice
Moisture content (%)	11.74 ± 0.74
Proteins (%)	7.50 ± 0.20
Lipids (%)	0.36 ± 0.01
Ashes (%)	0.24 ± 0.01
Total dietary fiber (%)	1.06 ± 0.22
Total carbohydrates (%)	80.16 ± 0.92
Thiamine (mg/100 g)	0.03 ± 0.00
Riboflavin (mg/100 g)	0.03 ± 0.00

CLASSIFICATION OF RICE AND RICE BY-PRODUCTS:**Flow chart: 2 Classification of Rice and Rice by-products****A. Rice Bran**

Rice bran is a brown layer presented between rice grains and the outer husk of paddy, which is rich in proteins, oil and other nutrients. Rice bran is by-product of the rice milling process (the conversion of rice to white rice), and it contains various antioxidants that impart beneficial effects, rice bran fraction contains 12%–13% oil and highly unsaponifiable components (4.3%). The bran layer is far from the kernel during milling and polishing, by applying friction to the grain surface either by rubbing the grains against an abrasive surface or one another. The quantity of bran removed is generally between 8-10% of the overall paddy weight but this may vary in keeping with the variability and degree of polishing required.¹⁷

Table no. 3 Composition of Rice Bran¹⁸**Figure No.3 Rice Bran**

Components	Percentage
Water	8.9-14.7%
Protein	10.6-13.4%
Fat	10.1-22.4%
N-free extract	38.7-44.3%
Fibre	9.6-14.1%
Pentosane	8.7-11.4%
Cellulose	11.4%
Reducing Sugars	1.3%
Sucrose	10.6%
Thiamine	27.9%
Pantothenic acid	7.1%
Vitamin E	30.0%

B. Rice Bran Oil (RBO)

Rice bran oil (RBO) is obtained through the extraction of rice bran which is a by-product of the rice milling industry. There are several techniques used to extract oil from rice bran such as supercritical carbon dioxide fluid extraction,¹⁹ compressed liquefied petroleum gas,²⁰ ultrasound-assisted aqueous extraction,²¹ sub-critical water extraction techniques,²² ultrasonic enzymatic extraction,²³ microwave-assisted extraction,²⁴ subcritical carbon dioxide and Soxhlet extraction²⁵ can be used to produce an oil that is free from toxic residues, having a high concentration of health components and a yield comparable to the conventional techniques.

Table no. 4 Composition of RBO²⁶

Composition	Percentage
Triacylglycerides	80.5
Diacylglycerol	4.8
Free fatty acid	6.8
Wax	2.9
Oryzanol	2.0
Phosphatides	2.9
Monoacylglycerol	1.7

Table no. 5 Standards of RBO²⁷

Characteristics	Value
Iodine value (wijs method, g/100g sample)	99-108
Peroxide value (meq/kg)	1.0 max
Moisture (%)	0.05max
Free fatty acid	0.05max
Saponification value	180-190
Refractive index	1470-1473
Acid value	1.2

Table no. 6 Methods of extraction²⁸

Method	Solvent	Yield
Solvent extraction	a) Hexane b) Ethanol	a) 92% b) 42.7 – 99.9%
Mechanical processing (less expensive) (small to medium scale)	-	80-85%
Soxhlet	a) Heptane b) Pet ether c) Hexane	a) 15-20% b) 18.4% c) 67.73%
SFE (high cost)	Carbon dioxide	19.2-20.41%
Sub critical fluid extract	a) Butane b) Propane	a) 89.11% b) 91.42%

C. Rice Bran Fatty Acid

The Rice bran fatty acid is a by-product originate during refining of rice bran oil (RBO) is natural derivative vegetable oil which bring an effective action in a variety of various external utilization in skin care products. Rice bran fatty acid contain high percentage of fatty acid which is a perfect skin moisturizer, antioxidant.

Rice bran fatty acid is prepared by neutralization method, this procedure is used to extract fatty acids from dewaxed oil.²⁹

Table no: 7. Composition Rice Bran Fatty Acid³⁰

Composition	Percentage
Myristic	0.25%
Palmitic	21.5%
Stearic	2.9%
Oleic	38.4%
Linoleic	2.2%
Arachidic	0.5%
Behenic	0.2%

D. Rice Bran Wax (RBW)

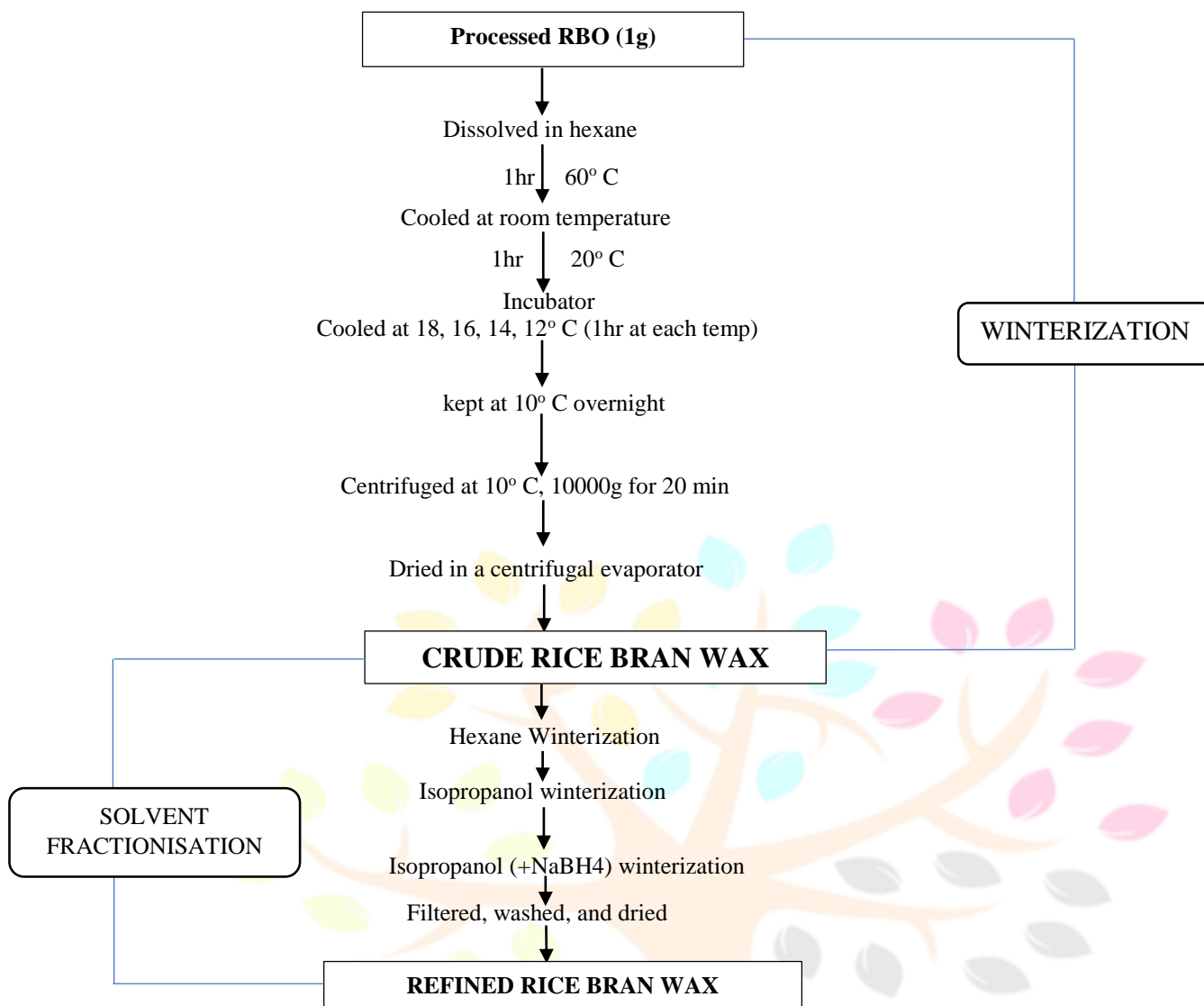
Refining of crude rice bran oil involves dewaxing, degumming, neutralization of free fatty acids, and winterization and solvent fractionization. Refined rice bran oil is a light-yellow colour with a mild background odor and flavour reminiscent of rice.³¹

Table no 8. Composition of Rice Bran Wax³²

Composition	
Aliphatic Acid	Palmitic acid(C16) Behenic acid(C22) Lignoceric acid(C24)
Higher Alcohol Esters	Ceryl alcohol(C26) Melissyl alcohol(C30)

Table no 9. Standards of Rice Bran Wax³³

Characteristics	Values
Solubility	Insoluble in water; soluble in ether ethanol & IPA
Melting Point	80.5 Celsius
Specific Gravity	0.912
Moisture Content	0.074% w/w
Saponification Value	80.88
Acid Value	2.848
Ester Value	78.04



Flow Chart 3: Preparation of Rice Bran Wax

E. Fermented Rice Water

Fermented rice water is a rice water that is left to ferment and has gone slightly sour.¹ It is rich in antioxidants, minerals, B vitamin, E vitamin, and traces of *Pitera*, a chemical produced by *Saccharomycopsis fibuligera* yeast during the fermentation process. It contains phenolic and flavonoids which can help to reduce free radical damage caused by environment.¹¹

Rice Water Prepared by three techniques:

- Rice Water produced using the boiling process (RWB): For 30 minutes, 400 g paddy rice whole grains were cooked in 1 L deionized water. Rice water was filtered through a cotton gaze and frozen at 30°C until needed.
- Rice Water Made with whole grain (RWM): 400 g paddy rice whole grains were combined with 1 L deionized water and shaken for 24 hours at room temperature. Rice water was then filtered through cotton fibres and frozen at 30°C until it was needed.
- Rice Water prepared by crushed grain (RWS): It is made by grinding 400 g of paddy rice grains into smaller bits for 10 seconds in a household grinder, then mixing it with 1 L of deionized water and shaking it for 24 hours at room temperature. Rice water was then filtered through cotton fibres before being frozen at 30°C until needed.³⁴

COSMETIC APPLICATION OF RICE:

A. Rice Water:

- 1) **Boosts skin barrier health:** Rice starch aid in the healing and maintenance of the skin's natural barrier. This assist to prepare the skin to combat constant aggressors, as well as prevent disorders like atopic dermatitis and environmental damage.¹⁷
- 2) **Mattifies oily skin:** Starchy rice water can have a pore tightening and toning effect when used on oily skin.¹⁶

- 3) **Astringent and Soothing property:** It gives soothing property for sensitive, acne and pimple skin and also acts as a natural astringent.¹⁷
- 4) **Sun Protecting Agent:** Rice water is a natural sunscreen, protecting from the harmful effects of UV rays. It is also used to treat sunburns. It also helps tighten open pores. It acts as cooling effect on mild sun damage like redness, sunburn, inflammation and itching.¹⁶
- 5) **Anti-ageing agent:** Skin texture and elasticity is restored by using rice water, especially in the case of dry and dehydrated skin. Rice water is rich in Vitamin A, Vitamin C, Vitamin E, flavonoids and phenolic compounds and it also contains ferulic acid and allantoin, all of which are necessary for skin function.³⁴
- 6) **Antioxidants:** rice water has shown to inhibit the action of elastase, a compound that causes damage to elastin in your skin and leads to premature aging.³⁴
- 7) **Enhances Complexion:** One of the key functions of rice water is brighter skin and an even skin tone. The skin brightening enzymes present in rice water known to fade dark spots, blemishes and brighten up the complexion for a clear and smooth texture.¹⁶
- 8) **Anti-frizz property:** Fermented rice water contains an ingredient called inositol, which has carbohydrate and is highly beneficial for hair. It makes hair soft and smooth, reducing the friction between hair strands and making them frizz-free.³⁵
- 9) **A natural cleanser for hair:** When it comes to cleansing hair, nothing can beat a shampoo. But most shampoos contain chemicals and additives that make hair dry and unhealthy over time, resulting in hair breakage, scalp infections, and dandruff. In such cases, a natural, strong cleanser like fermented rice water, which comes with zero chemicals gently cleanses the hair and leaves no dryness or itchiness on the scalp. In addition, it keeps the natural oil intact and uniformly maintains the pH level of the hair.³⁶
- 10) **Reduces hairfall:** Rice water is rich in protein, which aids in cell repair. When used on a daily basis it promotes the formation of hair cells, resulting in healthy hair growth. Hair strands gain protein over time and become stronger and firmer, giving your hair more volume and minimising hair loss.³⁵

B. Rice Bran

- 1) **Sun damage protection:** Rice bran's active ingredient, oryzanol, protects against UV-induced lipid peroxidation and can thus be utilised as a sunscreen. Tocotrienols present in rice bran stabilize the free radicals generated in the skin when exposed to oxidative rays. They protect the skin against UV induced skin damage and skin ageing and thus help in skin repair.³⁷
- 2) **Anti-Ageing Property:** The ferulic acid and its esters present in gamma oryzanol stimulate hair growth and prevent skin ageing.³⁸
- 3) **Antioxidant Property:** Rice bran bioactive components ferulic acid (F), gamma-oryzanol (O), and phytic acid (P) have been frequently employed in skin care products as antioxidant. Rice bran contains about 500 ppm tocotrienols, which enter and absorb quickly when applied to the skin. Majorly they get accumulated at the strata corneum of the skin and act as the first line of defence with their antioxidant property.³⁹
- 4) **Moisturising property:** The 20% rice bran fermentation solution had the best moisturizing effect.⁴⁰

C. Rice Bran Oil

- 1) **Protective agent:** Its γ -oryzanol content protects against the lipid peroxidation caused by UV light, and the ferulic acid and its esters present in the γ -oryzanol also stimulates hair growth.⁴¹
- 2) **Antioxidant agent:** The high concentration of antioxidants in Rice Bran Oil can flush out the toxins and free radicals from the follicles and roots, encourages production of melanin. Presence of vitamin E promotes healing and relieves a dry and itchy scalp.⁴²
- 3) **Softening property:** The squalene and tocotrienols present in the rice bran oil are important for skin softening and repair.⁴¹
- 4) **Promotes Hair Growth:** The linoleic acid and γ -oryzanol compounds present in Rice bran oil stimulate the formation of new hair follicles and has the power to encourage the hair follicles to transition into the anagen stage.⁴³
- 5) **Fights Dandruff and Hydrates Dry Scalp:** The high concentration of vitamin E encourages circulation to the scalp, which in turn, brings more nutrients to the scalp.⁴³
- 6) **Prevents Premature Greying:** Early greying can be due to sun damage. Premature greying from free radicals causes oxidative stress to the hair follicles. This stress prevents the melanin from reproducing and reaching our hair strands.⁴³

D. Rice bran fatty acid

- 1) **Skin brightening agent:** It helps to smooth skin tone provide an active component that maintains a youthful glow.⁴⁴
- 2) **Emulsifier:** Polyglycerol produced from glycerol of vegetable origins and rice bran oil fatty acid acts as emulsifier.⁴⁴
- 3) **Anti-ageing agent:** Oleic acid and Linoleic acid present in rice bran fatty acid has an anti-ageing property.⁴⁵
- 4) **Moisturizer:** Rice bran fatty acid contains a high percentage of fatty acid, a perfect skin moisturizer and antioxidant such as myristic acid and stearic acid.⁴⁵

E. Rice Bran Wax

- 1) **Emollient property:** It is used as an emollient, and is the basic material for some exfoliation particles.⁴⁶
- 2) **Gelling property:** It has been observed that rice bran wax at concentrations as low as 1 wt.% in triglycerides can crystallize to form stable gels.⁴⁷
- 3) **Moisturizing agent:** Helps preserve the moisture of the skin, acting as thin film coating the skin to prevent moisture evaporation. Moisturizes and softens skin as well as increases skin elasticity.⁴⁸
- 4) **Protect from Sun Damage:** 1.5% (w/w) Rice Bran Wax can increase SPF value by around 23%.⁴⁸

Table no 10. Concentration of use of Rice derived product.⁴⁸

Product category		Concentration of use (%)
1	Skin cleansing	• 0.5-1%
2	Moisturizing creams, lotions	• 8.0%
3	Suntan gels, cream and liquid	• 3.0%
4	Night cream	• 0.3%
5	Paste mask	• 0.2%
6	Makeup bases	• 3.0%
7	Foundations	• 0.5%
8	Lipsticks	• 0.1-1.0%
9	Bath oil, tablets and salts	• 1.0-39.0%
10	Eyebrow pencil	• 0.1%
11	Mascara	• 0.1%
12	Eye makeup preparations	• 0.5%
13	Hair Conditioners	• 0.3%
14	Hair Spray	• 0.1%
15	Shampoo	• 0.1-0.2%

DISCUSSION AND CONCLUSION

Rice is a staple diet for the vast majority of the region's people. It is the most important multipurpose ingredient used in cosmetic as it has multiple uses on skin and hair. Different parts of rice provide different properties to skin and hair. Rice bran comes from the outer layer of rice (*Oryza sativa*). Rice bran oil is popular as a "healthy oil" in Japan, Asia, and particularly India. While the Rice Bran Wax is a natural wax derived from rice bran oil. Rice Bran Wax has melting point between 75°C – 85°C, making it stable and suitable for cosmetic products such as lipstick, lip balm and products that require high viscosity. All these were extracted with different methods and techniques. Fermented rice water contains minerals such as vitamin B, C and E which are very important for skin care and hair growth. It is a natural ingredient; thus, it is biodegradable and it might be utilised as a substitute for a variety of synthetic cosmetic ingredients.

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