

The Potential of Black Rice In Cosmetics: First Applications and Scientific Review In Turkey

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Abstract

This study investigates the potential use of black rice, grown for the first time in Turkey in the Çilimli district of Duzce province, in cosmetic formulations. Black rice is rich in antioxidant, phenolic and flavonoid compounds that have positive effects on skin and hair health. The efficacy of Black Rice Extract in personal care products such as creams, tonics, solid shampoos and serums formulated according to natural and vegan principles was supported by laboratory analysis. The results show that Black Rice based formulations offer important benefits such as antioxidant protection, anti-aging and moisturizing, and these effects are supported by scientific data. This study provides an important contribution in this field in Turkey by introducing the innovative use of black rice grown in the Düzce region in the cosmetic sector.

Keywords: Natural cosmetics, Black rice, Antioxidant effects, Skin and hair health

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Kozmetikte Siyah Pirincin Potansiyeli: Türkiye'deki İlk Uygulamalar ve Bilimsel İnceleme

Özet

Bu çalışma, Türkiye'de ilk kez Düzce ilinin Çilimli ilçesinde yetiştirilen siyah pirincin kozmetik formülasyonlarda potansiyel kullanımını araştırmaktadır. Siyah pirinç, cilt ve saç sağlığı üzerinde olumlu etkileri olan antioksidan, fenolik ve flavonoid bileşikler açısından zengindir. Doğal ve vegan ilkelere göre formüle edilen krem, tonik, katı şampuan ve serum gibi kişisel bakım ürünlerinde Siyah Pirinç Ekstraktının etkinliği laboratuvar analizleri ile desteklenmiştir. Sonuçlar, Siyah Pirinç bazlı formülasyonların antioksidan koruma, yaşlanma karşıtı ve nemlendirme gibi önemli faydalar sunduğunu ve bu etkilerin bilimsel verilerle desteklendiğini göstermektedir. Bu çalışma, Düzce bölgesinde yetişen siyah pirincin kozmetik sektöründe yenilikçi kullanımını tanıtarak Türkiye'de bu alanda önemli bir katkı sağlamaktadır.

Anahtar Kelimeler: Doğal kozmetikler, Siyah pirinç, Antioksidan etki, Cilt ve saç sağlığı

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1. Introduction

Black rice (*Oryza sativa L. indica*) is a traditional rice variety that has been cultivated in Asia, particularly in China and Southeast Asian countries, for thousands of years [1] Black rice, also known as "forbidden rice" in China, was once considered a rare commodity available only to royalty. This rice is native to Asia and is cultivated in Düzce Çilimli, Samsun Bafra and Edirne İpsala in Turkey [2]. Today, black rice has gained popularity due to its high nutritional value and potential health benefits and has been used in various fields.

In terms of nutrient profile, black rice contains higher levels of powerful antioxidants such as anthocyanin pigments, phenolic compounds, flavonoids, and vitamins C and E compared to other types of rice [3]. These antioxidants provide an anti-aging effect by reducing the effects of free radicals in the body. Black rice is also high in fiber and important minerals such as iron, zinc, and magnesium. This rich nutrient content not only makes black rice a healthy food source but also enables it to play a supportive role in areas such as immune support and cardiovascular health [3].

In addition to nutrition, black rice is used as a natural colorant in the food industry, as a source of antioxidants in the pharmaceutical field, and as a skin health ingredient in the cosmetics industry. Rice, one of the most valuable nutrients known in human history, has an important place in the field of treatment and cosmetics, especially in Far Eastern countries. Treatments with rice water have been shown to be beneficial for many skin conditions [4]. Black rice, which is called a superfood in the world literature due to its richness in minerals and components, is an effective substance to reduce and eliminate the negative effects of sun rays, polluted air, UVB rays that our skin is exposed to during the day, with its strong antioxidant content [5]. In addition, with its antioxidant effect, it prevents skin wrinkles and plays a role in giving the skin a shiny appearance. In a study conducted in China, black rice powder was found to contain 10-30% anthocyanidin and 5-25% anthocyanins as a result of the test applied to black rice powder (research conducted by Shaanxi NHK Technology Co., Ltd.) [6] Kaneda et al. in their study "Antioxidative Compounds in the Extracts of Black Rice Bran" investigated the active compounds in traditional (white) rice bran extracts, especially black rice extracts, for their antioxidant properties and compared them with several authentic anthocyanin compounds [6]. The research results strongly supported that black rice bran extracts can be used as effective antioxidants in both cosmetic products and healthy foods. These extracts stand out for their ability to neutralize free radicals and prevent cell damage, making them a valuable ingredient that supports skin health and provides anti-aging effects [7]. Studies have shown that Yao women and ancient Chinese imperial princesses used the water in which they cooked their rice to wash their hair. It has also been observed that women who pick rice in the region have softer hands, fewer wrinkles on their faces, and whiter faces due to contact with rice. Based on observations and research, the Koreans, who are at the forefront of the cosmetic field of rice, a grain that is valuable in terms of nutrients and benefits, have recently

conducted serum and tonic studies on black rice. In the field of cosmetics made by Chinese companies and scientists on black rice, products such as shampoo and hair dye have been obtained from black rice. It has been found that black rice contains polyphenols and flavonoids, which protect the skin from ultraviolet rays and free radicals and promote the formation of new cells.

Anthocyanins from black rice have the potential to protect the skin from the damaging effects of free radicals and are considered a valuable ingredient in cosmetic formulations for their anti-aging and anti-inflammatory properties. In this regard, black rice has become popular in the cosmetic industry with the increasing demand for innovative and natural ingredients. The total phenolic content was found to be four times higher in pigmented rice than in non-pigmented varieties [8]. Red and purple rice varieties showed higher total phenolic and flavonoid content and antioxidant activity than light-colored varieties such as white and brown [9].

1.1. Chemical and Nutritional Composition of Black Rice

Black rice is a rich source of ingredients that support skin health. It contains anthocyanins, pigmented compounds with powerful antioxidant properties. These compounds neutralize free radicals, allowing skin cells to fight oxidative stress, preventing premature signs of aging. Anthocyanins also reduce inflammation in the skin, helping to prevent skin problems such as acne. Black rice is also rich in flavonoids. Flavonoids help regenerate skin tissue and increase skin elasticity by stimulating collagen production. Vitamin C and vitamin E in black rice also play an important role in skin protection. Vitamin C prevents free radical damage to the skin, while vitamin E moisturizes and protects against dryness. In addition, the beneficial effects of minerals such as zinc and iron on the skin accelerate its healthy appearance and healing. With its antioxidant capacity and nutritional content, black rice has an important place in cosmetic formulations as an ingredient that supports skin health both internally and externally.

Black rice has a richer nutritional profile than white rice. High in fiber, minerals and vitamins, black rice is an important part of a healthy diet. The high fiber content in black rice helps regulate the digestive system, supports intestinal health, and provides a feeling of fullness. Fiber also increases insulin sensitivity by balancing blood sugar levels. Black rice is also a rich source of antioxidants. The name black rice is associated with the accumulation of cyanidin-3-glucoside, the main anthocyanin that gives rice its characteristic dark color [10]. These anthocyanins belong to the flavonoid class of compounds and are potent antioxidants that play an important role in protecting cells from oxidative stress. The presence of these pigments not only contributes to the unique appearance of black rice but also enhances its nutritional and health benefits in terms of antioxidant properties. Black rice has been confirmed to have the highest total anthocyanin content (327.60 mg/100 g) among all colored grains studied [11]. In addition to their skin benefits, these compounds reduce cell damage by fighting free radicals in the body and may help fight health problems such as cardiovascular disease, cancer, and aging. Anthocyanins extracted from black rice, particularly cyanidin and peonidin-3-glucoside, have been shown to inhibit cancer cell proliferation in vitro [12]. In addition, minerals such as zinc, iron,

magnesium, potassium, and magnesium in black rice are critical for various functions of the body. These minerals strengthen the immune system, support bone health, and contribute to energy production. Vitamin C strengthens the immune system, while vitamin E helps maintain healthy skin. In addition, B vitamins play a role in energy production and support nervous system health. However, its natural pigment content and healthy ingredients make it a highly valuable nutrient in food and nutrition.

1.2. Examples of Literature Studies on the Use of Black Rice in Cosmetics

In the study "Black Rice (*Oryza Sativa L.*) Extract Modulates Ultraviolet-Induced Expression of Matrix Metalloproteinases and Procollagen in A Skin Cell Model" by Han et al. it was shown that anthocyanins from black rice bran have the ability to scavenge reactive oxygen species (ROS) caused by ultraviolet (UV) rays, suppress the expression of matrix metalloproteinase (MMP) enzymes and increase procollagen production. If these effects are confirmed by human clinical trials in terms of stability, safety and efficacy, it is suggested that black rice extract could be used as a cosmetic ingredient to prevent photoaging of the skin [13].

In the study "Photochemistry, Functional Properties, Food Applications, And Health Prospective of Black Rice" by Rahim et al, it was found that black rice, which is rich in anthocyanins, may be a source of antioxidants that can prevent or limit the formation of reactive cell-damaging free radicals. The researchers emphasize the potential of black rice for use in cosmetics thanks to this property [14].

In the study "Black Rice Bran (*Oryza Sativa L. Indica*) Extract Cream Prevented the Increase of Dermal Matrix Metalloproteinase-1 and Dermal Collagen Reduction of Male Wistar Rats (*Rattus Norvegicus*) Exposed to Ultraviolet-B Rays" by Haryanto et al, it was supported by studies that black rice bran delays skin aging and collagen loss and prevents photoaging due to its antioxidant structure. These findings underscore the positive effects of black rice bran on skin health and highlight its importance as a potential ingredient for cosmetic applications [15].

Thitipramote et al. in their study entitled "Health Benefits and Safety of Red Pigmented Rice (*Oryza sativa L.*): In Vitro, Cellular, and In Vivo Activities for Hair Growth Promoting Treatment," experiments on mice showed that black rice provides effective results in in vivo hair treatments for hair growth promotion and hair growth treatment [16].

2. Materials And Method

The total phenolic and flavonoid contents of Black Rice and Kasaba Rice were measured by FCR (*Folin-Ciocalteu Reagent*) method in UV spectrophotometer device in the analyses performed at Düzce University Scientific and Technological Research Application and Research Center (DÜBİT). These analyses of phenolic compounds support the usability of black rice in the cosmetic industry (Table 1).

Table 1. Comparison of Kasaba Rice and Çilimli Black Rice.

	Kasaba Rice	Çilimli Black Rice
Color	White	Black
Place of Cultivation	Düzce	Düzce
Harvest Year	2022	2022
Flavonoid	1,016 mg QE/g	5,141 mg QE/g
Phenolic	0,94 mg GAE/g	13,77 mg GAE/g

QE: Quercetin equivalence, *GAE*: Gallic acid equivalence

The results of the analysis clearly demonstrate the high antioxidant properties of black rice. When black rice was compared to white rice, the total phenolic content of black rice was found to be approximately 15 times higher, and the total flavonoid content was found to be 5 times higher than that of white rice. These findings confirm that black rice is a powerful source of antioxidants due to its rich phenolic and flavonoid content.

The literature review shows that flavonoids and phenolic compounds (especially anthocyanidins) account for approximately 25% of the total content in the analysis of black rice [17]. These results confirm that black rice is a rich source of active ingredients. With reference to these analytical results in the literature, the extracts prepared using Çilimli black rice as a sample were reanalyzed and the results obtained were compared and evaluated. This process provided a better understanding of the potential uses of Çilimli Black Rice and its suitability for sectoral applications.

Black Rice is a raw material that attracts attention with its rich mineral profile that has been detailed by XRF (X-Ray Fluorescence) analysis. As a result of the analysis carried out by the Izmir Institute of Technology Laboratory, it was found that black rice contains minerals such as Potassium (37.05%), Phosphorus (23.91%), Magnesium (7.962%), Sulphur (6.546%), Calcium (2.767%), Zinc (1.239%) and Iron (0.690%). This analysis shows that black rice is not only a product of high nutritional value, but also a powerful source of minerals for cosmetic formulations. In particular, the skin health properties of minerals such as potassium, magnesium and zinc make the use of black rice in cosmetic products even more valuable. These results allow the use of locally grown black rice as a raw material in natural and near-natural cosmetic products, while opening the door to innovative approaches.

In the process of developing and analyzing black rice extracts, a comprehensive evaluation was carried out using different extraction methods. Five of the extracts were selected for antioxidant activity analysis, and biochemical analyses performed at Ege University Central Research Test and Analysis Laboratory scientifically demonstrated the antioxidant capacity of black rice extracts. The DPPH (2,2-diphenyl-1-picrylhydrazyl) method was used to measure the radical scavenging rates and ascorbic acid equivalents of the black rice extracts and to confirm their antioxidant potentials. According to the data obtained, the % radical removal rates of black rice extracts ranged from 11.42% to 63.32%, and the

highest activity was determined to be 63.32%. The ascorbic acid equivalents ranged from 1.7 mM to 6.3 mM (Table 2).

Table 2. % radical removal rates of black rice extracts

Sample Extract	1	2	3	4	5
%Expense(10x dilution)	40,6	11,42	56,8	31,31	63,32
Ascorbic acid equivalent (mM)	4,3	1,7	5,8	3,5	6,3

In particular, the black rice extract with a radical scavenging rate of 63.32% shows a strong antioxidant capacity. This highly active extract was then incorporated into the formulations of cosmetic products such as creams, tonics and serums. This process illustrates how optimization of extraction methods and antioxidant activity assays are critical in the selection of ingredients with biological activity. The identified extract is used as a raw material that can contribute to important functions in cosmetic formulations such as free radical neutralization, skin barrier strengthening and promotion of anti-aging effects.



Figure 1. Black rice raw and powdered form used in the extract.



Figure 2. Preparation of black rice extract.



Figure 3. Trials of black rice extract in serum formulation studies.

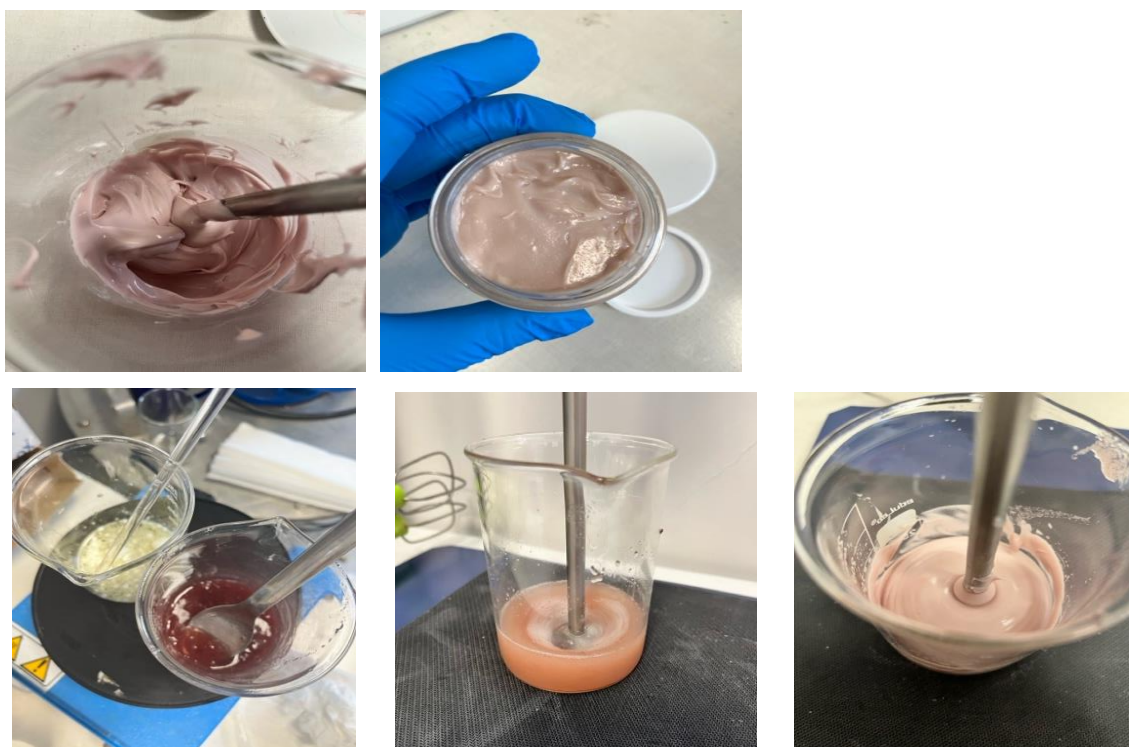


Figure 4. Trials of black rice extract in cream formulation studies.



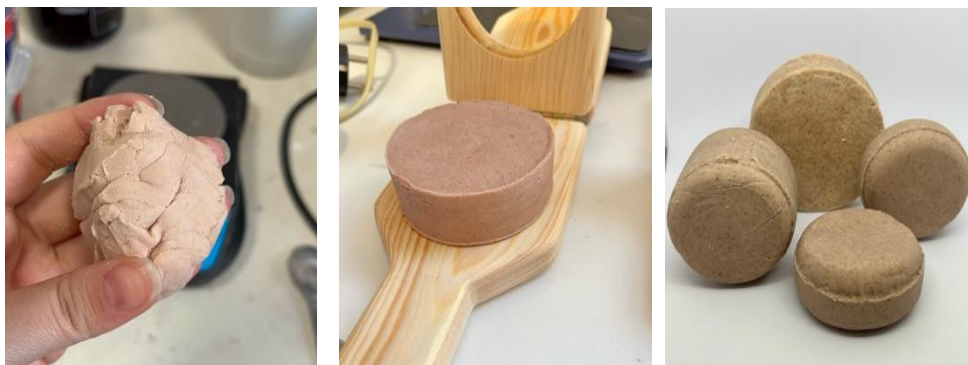


Figure 5. Trials of black rice extract in solid shampoo formulation studies.



Figure 6. Trials of black rice extract in exfoliating mask formulation studies.

3. Results & Discussion

The use of black rice in the cosmetics industry is an innovative approach due to its rich structure in antioxidants and phenolic compounds. Until now, black rice, which has been used in Korean cosmetics by brands such as Haruharu and Grace Day in the production of serums and tonics, has remained limited as an imported ingredient in our country. However, a first in this field has been achieved with black rice grown in Düzce Çilimli. With the support of KOSGEB's R&D, P&D and Innovation Project in 2023, Emek Laboratory conducted a comprehensive study to develop natural and near-natural cosmetic products using black rice. This project not only made it possible to use black rice as a cosmetic raw material for the first time in Turkey but also pioneered the development of domestic and innovative products. This work is significant not only in terms of reducing import dependency, but also in terms of demonstrating Turkey's potential to transform its natural resources into value-added products. Black rice grown in Düzce Çilimli has a great potential for the cosmetic sector due to its rich antioxidant content. Our company compared black rice, which is reported in the literature to contain higher amounts of phenolic compounds and flavonoids than white rice, with local white rice, especially Kasaba rice. Analyses revealed that phenolic compounds in black rice are effective in combating oxidative stress due to their free radical scavenging abilities. These compounds exhibit antioxidant properties by donating a hydrogen atom in hydroxyl groups, and thanks to these properties, they protect

the skin from UV rays and delay aging. In addition, flavonoids and phenolic compounds have antimicrobial properties and support skin health [18].

As a result of the studies started in 2021, our company has launched Black Rice Extract Solid Shampoo for the first time in Turkey. This product, which is in the patent process with the number 2024/004305, supports hair and scalp care with natural oils and ingredients and does not contain harmful chemicals such as SLS and parabens. Adopting a zero-waste philosophy with its environmentally friendly structure, our shampoo offers long-term ease of use. Thanks to the antioxidants and flavonoids it contains, our product prevents hair loss, prevents and repairs hair breakage, while nourishing the scalp, increasing blood circulation and accelerating hair growth.

This study demonstrates the importance of scientific approaches and comprehensive analysis in transforming locally produced raw materials into value-added cosmetic products. The strong antioxidant activity of black rice extract has the potential to provide anti-aging and skin protective effects. In this context, black rice offers a natural and sustainable raw material alternative that can be evaluated as a valuable ingredient for skin protection and anti-aging products in cosmetic formulations.

The use of black rice, an agricultural product that is a powerful source of antioxidants and minerals, in the cosmetic industry is a highly innovative approach. Under the Laborem Natura brand, an important step has been taken with the production and development of products containing black rice extract.

In particular, the launch of products such as Solid Shampoo, Anti-Aging Cream and Make-up & Skin Cleansing Bar is noteworthy for consumers looking for natural and effective cosmetic solutions. In addition, the R&D studies conducted for products such as Tonic, Serum and Exfoliating Mask demonstrate the brand's innovation-oriented approach.

With its nutritional and antioxidant properties, black rice stands out as a beneficial ingredient for both skin care and general health. The realization of such an innovation with local production is of great importance both in terms of the effective use of our country's agricultural resources and in terms of making a difference in the field of cosmetics.

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