



## **Novel Health Care Products produced from Rice and Rice By-products**

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### **ABSTRACT**

*Rice milling process produces several by-products like husk, bran germs along with milled rice. These by-products are treated as waste products although they are potential source of many valuable components. Rice bran, for example, is a potential source of edible high quality oil known as Rice Bran Oil (RBO), protein, cholesterol-lowering waxes, anti-tumour compounds, and various antioxidants which have various skin beneficial properties. Keeping in mind the enormous potentials of various fractions of rice, attempts were made to develop under mentioned rice based products having different health care properties. 1) Moisturizing lotion: This is a skin care product which is light, non-sticky and smooth, and found suitable for normal and oily skin. Its regular application makes skin smooth, soft and supple. Majority of the respondents considered this product better / much better than the available products in the market. 2) Cream for Cracked Heel and Dry Skin: This product is useful for cracked heels, dry skin disorder. It helps in arresting the bleeding due to cracks and reducing the pain. 3) Pain Relieving Gel: The product is highly effective for minor aches and pains of muscles and joints associated with simple strains, bruises and sprains. Majority of the respondents during testing felt that the product was better / much better than the available products in the market. 4) Face Scrub: This is an exfoliation product which has been designed specifically for use on the face. The product was very much liked by all the respondents. Regular use of this product keeps skin smooth and glowing by removing dead skin, and exposing a layer of younger, healthier skin.*

*India has potential to produce 1.47 Mt of rice bran oil but the actual production RBO in 2013-14 was 0.93 Mt only which was just 63.26% of the potential. Hence, there is vast scope to utilise rice bran oil and other by-products in making novel rice based products which will enhance the profitability of the rice farmers and will also generate rural employment.*

**KEY WORDS:** Rice by-products, Rice bran oil, skin care products, face scrub, rice bran

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### **INTRODUCTION**

Indian farmers have contributed to the food security of the country while remaining in perpetual stress. The low and highly fluctuating farm income is causing detrimental on the interest in farming and farm investment, and is also forcing more and more cultivators, particularly younger age group, to leave farming. This can cause serious adverse effect on the future of agriculture in the country. To promote farmers' welfare, reduce agrarian distress and bring parity between income of farmers and those working in non-agriculture professions, Hon'ble Prime Minister of India has emphasized for doubling of the income of farmers of the nation by the year 2022 when the nation will celebrate 75<sup>th</sup> year of independence. After his call, elaborate and extensive exercise has been started by the Niti Aayog for devising appropriate strategies throughout the country on this mandate.

There are several pathways that can lead to step up in income of which increasing production through rise in yields, cost reduction, water management, stabilising income through risk coping and mitigation measures, diversification within farm sector and towards non-farm sector are a few important ones. Appropriate use of whole biomass/ by-products of crop will also enhance the income of the farmers. Moreover, it will generate employment opportunities. India is second largest producer of rice (104.32 million tons, 2015-16) in the world next to China (GOI, 2017). Rice occupies first place both in area and production and is the staple food for more than 65% population of India.

Paddy is composed of three basic components namely the hull, the bran and the kernel. In an ideal milling process it produces about 20% husk, 10% bran and 68%-72% milled rice or white rice (Azam et al.,

2017). The minor components of rice milling, such as rice husk, rice germ, and bran, are treated as waste products by the rice milling industry instead of useful by-products. Rice straw is another agricultural waste that is abundantly available.

Rice bran is one of the valuable by-products of the rice processing industry. It is a potential source of edible high quality oil known as Rice Bran Oil (RBO), protein, cholesterol-lowering waxes and anti-tumour compounds like rice bran saccharide (Saunders, 1985, Orthoefer, 1996).

Rice Bran Oil (RBO) contains various antioxidants like tocopherols, tocotrienols,  $\gamma$ -oryzanol, phytosterols, polyphenols, squalene etc (Vikas Pali, 2013). These antioxidants help fight free radicals and aid in slowing down the effect of aging. Oils also contain proanthocyanidines which in turn play an important role in maintaining the suppleness of skin. The oil has skin tightening property. It is easily absorbed by the skin. The oryzanols present in oil can intercept ultraviolet rays and has skin whitening property (Noboru & Yusho, 1970). It finds applications in sun screen agents, as an antioxidant and preservative in cosmetics and food preparations, in the treatment of atopic dermatitis, in senile xeroderma, and in the prevention of skin dryness. Phytosterols provide calming and soothing properties when used topically.

Keeping in mind the enormous potentials of various fractions of rice, attempts were made to develop various rice based products having different health care properties.

## **MATERIALS AND METHODS**

Oil was extracted by soxhlet extraction method using petroleum ether as solvent. 300 ml of solvent was poured into a round bottom flask. 100 g of the fresh bran sample obtained from the milling of brown rice was placed in the thimble and was inserted in the centre of the soxhlet. The solvent was heated at 40-60 °C. When the solvent was boiling the vapour rose through the vertical tube into the condenser at the top. The liquid condensate dripped into the filter paper thimble in the centre which contained the solid sample to be extracted. The extract seeped through the pores of the thimble and filled the siphon tube, where it flowed back down into the round bottom flask. This was allowed to continue for 6 hours. The solvent was removed under reduced pressure. The oil obtained was used in the preparation of the products.

Starch was extracted from brown rice using water as solvent. Freshly isolated starch was used as one of the ingredients of the some products. Other ingredients were of pharma grade purchased from the market.

### **MOISTURIZING LOTION**

The product, Moisturizing Lotion is a skin care product made from rice bran oil and aqueous brown rice extract as key ingredients. Due to brown rice, the product also contains Oryzanol, vitamins and other antioxidants like tocopherols, tocotrienols, phytosterols etc. These antioxidants fight with free radicals and slow down the effect of aging.

### **PAIN RELIEVING GEL**

This product contains known natural/ herbal ingredients like Camphor, Menthol, Methyl salicylate, Eucalyptus oil, Rice bran oil as key ingredients.

The product Pain Relieving Gel is meant for topical application. The product is highly effective for minor aches and pains of muscles and joints associated with simple strains, bruises and sprains. It should be applied by gently massaging on the affected area until it penetrates the skin.

### **CREAM FOR CRACKED HEEL AND DRY SKIN**

The major ingredients of the product are rice bran oil, brown rice extract, humectant and water. Gamma oryzanol, tocopherols, tocotrienols, sterols etc are other bioactive minor components present in the product. This product in the form cream is useful for therapeutic and cosmetic applications such as cracked heels, dry skin disorder.

### **FACE SCRUB**

Main ingredients of the product are rice bran oil, rice flour from broken rice, humectant. Gamma oryzanol, tocopherols, tocotrienols which are potent antioxidants, are also present as minor constituents. Broken rice powder acts as a mild abrasive which pulls away dead and dying skin cells when rubbed gently on the face.

## **EVALUATION OF THE PRODUCTS**

Products were evaluated by volunteers. They were given written instructions and asked to evaluate the products for acceptability based on its color, texture, smell, irritation, ease of use, speed of absorption and overall acceptability. A 5 point hedonic scale (5 = Like very much, 4 = Like, 3 = Neither like nor dislike, 2 = Dislike, 1=Dislike very much) was used to determine the acceptance rating for sensory parameters - appearance, color, odour, tenderness, taste and overall acceptability (Nobile, 2016). Respondents were asked to evaluate the skin conditions like appearance, intactness, moisture content and sensation, after use of the test products on a 5 point scale (1= bad, 2= abnormal, 3= no change, 4= good, 5= very good). In

the third section of the questionnaire, respondents were asked to compare with market products on 5 point scale (1= much worse, 2= somewhat worse, 3 = about the same, 4= somewhat better, 5 = much better).

## **RESULTS AND DISCUSSION**

### **Moisturizing Lotion**

The product is light, non-sticky and smooth, and found suitable for normal and oily skin as told by the majority of the respondents (60%). Majority of the respondents (75%) felt that the product upon application gets absorbed quickly and it can be applied daily on face and body for moisturizing the skin. It has been observed that its regular application makes skin smooth, soft and supple, this was the response of 100% users. None of the users reported any side effect of the product. Majority of the respondents (62.0%) considered this product better / much better than the available products in the market and remaining 38% users felt that this product is at par with market product. The starch extracted from brown rice acts as a gelling agent in the formulation and provides moisture to skin slowly but for a longer period of time. Moreover, the oil and the brown rice extract in this formulation contain various skin beneficial ingredients contributing to suppleness, tightening, lightening and preventing dryness of the skin. On account of oryzanol, a potent antioxidant, the product has also anti-aging property. Most of the users found this product superior to the products available in the market.

Production Cost: At laboratory scale, production cost of 100 g of the product is only Rs. 13/-. Small scale entrepreneurs can start business. With facility costing Rs. five lakhs one can produce 50 kg of the product every day.

### **Cream for Cracked Heel and Dry Skin**

The formulation, apart from healing the cracks on heels, is useful in arresting the bleeding due to cracks and reducing the pain as told by majority of the users (76%). The cream has the excellent effects of softening the heel and the foot skin. It enhances skin elasticity. Interestingly, compared to commercially available products, the recurrence of cracks is less severe. 100% users were satisfied with this product. The composition of the formulation is new, very safe, eco-friendly and does not produce any harmful effects.

This is product has also become very popular among the users. Cracks in heel disappeared within a week, this was reported by the all users. Majority of the respondents (82.0%) considered this product better / much better than the available products in the market.

Production Cost: At laboratory scale, the production cost of 50 g of the product is Rs. 25.50 which can be further reduced if prepared at commercial scale.

### **Pain Relieving Gel**

All users (100 %) users reported that they got immediate relief from muscle pain/sprain/joint pain. They are also satisfied or extremely satisfied with the performance of the product. The product absorbs quickly in the skin, it was felt by 57% of users and remaining users (25%) reported that the absorption time was normal. Majority of the respondents (71.5%) felt that this product is better / much better than the available products in the market.

Rice bran oil in this formulation has been used as a carrier and serves as an excellent base for dissolving natural pain relieving ingredients and making it an efficient pain relief product. As rice bran oil absorbs well in the skin, the dissolved active ingredients in the oil also get absorbed fast and provide quick relief. It is a quick absorbing fast pain relief product as endorsed by users.

Moreover, Composition of the active ingredients also provides synergistic effects. This product having herbal ingredients is different from the available products of this category as most of the available products in the markets have synthetic base and /or synthetic analgesic ingredients.

Production Cost

The production cost of the product at laboratory level is Rs. 20/- per 25 g. With the investment of Rs. five lakhs, one can produce 50 kg of the product daily.

### **Face Scrub**

This Face Scrub is an exfoliation product which has been designed specifically for use on the face. The product was very much liked or liked by all the users (100%). Regular use of this product keeps skin smooth and glowing by removing dead skin, and exposing a layer of younger, healthier skin, this was the feeling of 95% users. The product is mild enough to be approved for daily use by male and female both.

Rice bran oil being an emollient nourishes the skin while removing dead skin. Although the product is oil based, it can easily be washed off with water. After rinsing off, the skin becomes smooth, soft and moist. It does not require application of another moisturizing cream. Regular use of the product protects from the problem of blemishes and dark spots, and flakes around nose and chin area.

Most of the facial scrubs available in the market contain sharp and hard abrasive particles like crushed apricot kernel, almond shell, sugar and salt crystals, pumice etc which are extremely harsh for skin and cause skin damage. In our product, rice grain flour is used as exfoliant which is mild and soft towards the skin. Because of this mildness, the product can be used regularly.

Production Cost : Cost of production at laboratory scale is Rs. 18/ per 100 g. With the investment of Rs. five lakhs, one can produce 80 kg of the product daily.

#### RBO PRODUCTION POTENTIAL

Rice bran accounts for 8-12% of the total weight of rough rice. This is potential source of oil, high quality protein, dietary fibre, vitamins etc. India has the largest area (42.4 m ha) in rice cultivation with a production of 159.81 Mt of paddy during 2013- 14, which is equivalent to 106.54 Mt of rice (67% recovery), which could yield 8.63 Mt of rice bran (if 90% paddy is used for consumption and bran recovery is 6%). This amount of bran would have the potential to yield 1.47 Mt of rice bran oil (17% recovery). However, the actual production RBO in 2013-14 was 0.93 Mt, which was just 63.26% of the potential (Azam et al., 2015). Hence, there is vast scope to utilise rice bran oil for rice based products in order to enhance the profitability of the rice farmers and also to generate rural employment.

All the developed products contain rice based ingredients like rice bran oil, brown rice extract, broken rice flour, and oryzanol, tocopherols etc as minor ingredients.

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