



## INVESTIGATION ON PRODUCTION OF EDIBLE OIL FROM RICE HUSK

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### ABSTRACT

Rice husk, the hard protective covering of the grain of rice (paddy), is a massive agricultural residue. Rice bran oil (RBO) also called wonder oil is well known for its numerous health benefits. The presence of a unique antioxidant called oryzanol contributes maximum antioxidant activity to rice bran oil. Rice bran oil has number of advantages over the other edible oil. The results showed that the rice bran has 21.44% of raw oil, with a chemical composition (based on fatty acids) of 48.48% oleic acid, 35.26% linoleic acid, and 14.54% palmitic acid, as well as a free fatty acid content of 8.15%. The oil contains vitamins such as B and E, proteins, fatty acids, antioxidants, collagen, elastin, oryzanol and ferulic acid. Antioxidants and Vitamin E are good for the heart as they reduce the amount of bad cholesterol and prevent cardiac arrest. Compounds such as oryzanol and ferulic acid are used as functional food supply ingredients. Apart from these benefits, the consumption of rice bran oil maintains the immune system, aids in weight loss, prevents diseases like cancer, relieves symptoms of menopause and enhances skin health. These advantages motivate capitalists to venture into rice bran oil manufacturing and thus can supply cooking oil and various other essential products that require rice bran oil as a component of it. Is. Although it is classified as an “oil”, rice bran oil is completely safe for consumption by patients with heart problems, diabetes, cholesterol, or high blood pressure. Because of all these benefits, you can expect good profits in the Rice Bran Oil Making Business.

**Keywords:** Rice husk, protective layer, agricultural residue, wonder oil and antioxidant

### 1. Introduction

Rice Bran Oil (RBO) is an edible oil extracted from rice bran which is a byproduct of rice mills. RBO is superior among the other edible oils because it contains unique antioxidants and nutraceutical complexes present in its composition. In the unsaponifiable fraction of RBO contains g-oryzanol and tocopherols [1,2]. These compounds have been reported in the scientific literature as powerful antioxidant agents that are effective for preventing degenerative diseases. It is suggested that bran antioxidants are mainly g-oryzanol and vitamin E, as well as unsaturated fats capable of lowering cholesterol. g-oryzanol component of RBO was first presumed to be a single component, but later it was determined to be a fraction containing ferulate (4-hydroxy-3-methoxy cinnamic acid) esters of triterpene alcohols and plant sterols [3-6]. Cycloartenyl ferulate, 24-methylenecycloartanyl ferulate, and campesterol ferulate are the three major components of g-oryzanol.

Under-nourishment is the problem that all the developing countries face to-day. Studies carried out by the United Nations have indicated that diets of the

people in these countries are deficient in calories [7-11]. Similar is the case with India, where the prices of oils and fats are always on the ascent. The reasons for this are (i) over increasing population and (ii) rise in standard of living of bulk of the lower echelons of the population. These factors have increased and continue to increase the demand for oils and fats both for edible and non-edible purposes, But the increase in the production of oil seed crops is not in keeping with the increasing demand, so much so that India, an exporter of oil twenty years ago, is forced to-day to import oil for domestic consumption [12-16]. This is true for both edible and essential oils. The short supply of oil has not only created a food problem, but has hit the industrial scene in a big way.

During the rice polishing process, a unique vegetable oil that is rich in antioxidants produced from the outer layer of rice is what we called Rice bran oil (RBO). The global studies have confirmed the cholesterol lowering properties due to the presence of unique nutraceuticals in this oil known as oryzanol & tocopherols. The crude rice bran oil is mainly composed of glycerides (80%) while phospholipids, glycolipids, free fatty acids and waxes are also present in less

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quantity [17-22]. RBO is extensively used as premium edible oil in most of the Asian countries (Japan, Korea, China, Taiwan and Thailand). It is the conventional & the most favorite cooking medium of the Japanese and is popularly known as "Heart Oil" in Japan. It has acquired the status of a "Functional Food" or a "Health Food" in Western Countries. As per the Cardiologists' Society of India, 30% of India's population is prone to cardiac problems. Since every 1% reduction in Cholesterol, reduces the risk of heart attack by 2%, Rice Bran Oil can become a boon for the people.

RBO will give better realization of paddy to Indian farmers. The RBO is rich source of antioxidants especially phytochemical oryzanol, tocopherols and tocotrienols which contribute to higher oxidative stability and longer shelf life than other edible oils. According to the recent studies, the oxidative stability of RBO is 2.5-5 times more than groundnut oil [23]. RBO is good source of mono-unsaturated fats and cholesterol and has been proved to be effective in reducing LDL (bad cholesterol) by 7-10%. The high smoking point (213C) prevents fatty acid breakdown at high temperatures which retains its antioxidant activity. Based on the results of the existing study on the RBO, and that the optimization of the extraction process is very much related to production costs, as well as considering the needs of the RBO extraction industry for the pharmaceutical and food industries related to the optimization of the extraction process, then this research was conducted. The novelty of the work is in RBO processing, feasibility to obtain good quality oil with low refining loss and high oil extractability by using the appropriate solvent.

## 2. Literature review

Fernanda Andreola et.al suggested that the possibility to use rice husk ash as silica precursor for the development of praseodymium doped zircon yellow pigment. The characterization carried out corroborates the thermal and chemical stability of the synthesized powders and allow us to determine the optimal synthesis conditions for the formation of the Pr-ZrSiO<sub>4</sub> solid solution. The obtained pigments are stable and develop an intense yellow color that is very similar to the color developed by the pigments obtained starting from pure quartz. Considerable efforts are being taken worldwide to minimize the cost of the pigments that are very incident on the total price of a low added value product as the ceramic tile. Moreover, the recycling of material can be seen as a prevention of waste produced in the context of extracting raw materials. Regarding the brick manufacturing, this research has reveals that RHA behave as raw materials with high silicate content which have mainly plasticity reducing effect of the brick

bodies. Bricks containing higher amounts of RHA could be used in building manufacturing (light weighted faced load bearing walls) where moderate strengths and penetration protection porosity/permeability) are required.

Sri Handayani et.al revealed that the optimum conditions in rice bran oil extraction in this study were 4 hours and 75% bentonite adsorption from CRBO yielded 11% yield, 8% water content, AV 67 mg NaOH /g sample, PV 21 mgrek/g sample, IV 21 mg I<sub>2</sub>/g sample, and 68% unsaturated fatty acids and 29.5% unsaturated fatty acids. Further research on rice bran oil produced will be carried out to produce trioxolane compounds.

G.K.Roy and H.N.Sharat Chandra described that rice bran oil industry has a wide scope for development in Orissa. Production of oil seeds used for extraction of edible oils is very scanty. At the same time, the availability of oils for soap, hydrogenation, cosmetics and other allied industries is also very limited. A positive answer to this is the rice bran oil both in its crude and refined form. Orissa is one of the major rice producing states in the country. The total annual production amounts to about 4 million tonnes, which constitutes nearly 10% of the country's production. The processing of this rice produce rice bran amounting the 240000 tons with an average oil content of 14% (the range being 8-20%) this bran will yield 33600 tons of crude rice bran oil. This can be put to subsequent use for obtaining a host of products. There is no difficulty for the growth of a few industrial units on the small scale for the extraction of oil from rice bran. The capital investment for a unit processing 25 tons of rice bran per day will be approximately rupees 36 lakhs. Judging from all these points it can aptly be concluded that rice bran oil is an important future source for edible and essential oils in Orissa.

Gulzar et. al revealed that RBO is unique edible oil with numerous health benefits but it has a major disadvantage which can outweigh its benefits. The absence of omega-3- fatty acids is the only major problem concerned with RBO. Although RBO reduces cholesterol level but the presence of high excess of omega-6-fatty acids could be detrimental to health. A high consumption of omega-6-fatty acids may increase both breast cancer and prostate cancer. Rice bran itself is potentially high in arsenic so this is another level of concern which requires more research. There are also few side effects of RBO like gas, flatulence, stomach discomfort. RBO has also been reported that it lowers the blood calcium in body which is a health concern for people with hypocalcemia. The flow diagram of the present study is shown in Fig. 1.

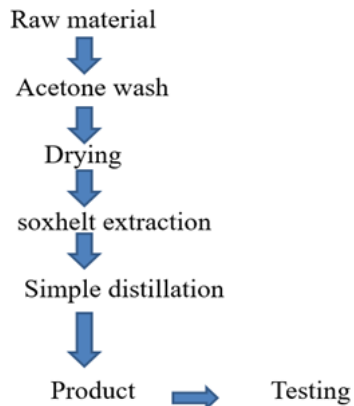


Fig. 1 Methodology

### 3. Experimental

#### 3.1 Materials

##### 3.1.1 Raw material preparation



Fig. 2 Raw material (raw rice bran)

Fig. 2 clearly shows the sequence of steps involved in preparation. First of all, the powdered the rice husk is converted into small particles. Then it is screened into smaller particles to get more surface area to react with the solvent to get a higher yield. It is weighed as 50 grams of rice husk.

##### 3.1.2 Acetone washing

About 100 ml of acetone for washing the rice husk is taken (Figure 3). By using the acetone can remove the impurities or foreign materials which have been mixed with the rice husk. We took the rice husk and acetone in the ratio of 1:2. It looked like a slurry. We had tried to dry the rice husk which was mixed with acetone by using the sunlight. From that 50% of the raw material was dried. Then the process started to heat the raw material and it was dried completely.



Fig. 3 Acetone washing

##### 3.2.3 Raw material packing

The raw material is packed and it can be kept inside the extractor. The raw material is packed by using the wattman filter paper (Figure 4 and 5). It is rolled like a cylindrical shape and the raw material is packed into it. We had measured the 200 ml of n-hexane in the round bottom flask. The boiling point of n-hexane is 69 degree Celsius. We had kept the heating mantle temperature at 70 degree Celsius.



Fig. 4 Raw material preparation

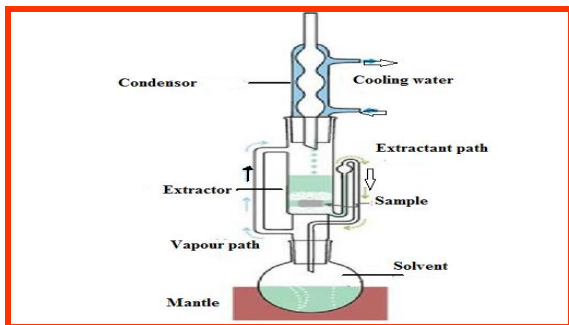


Fig. 5 Oil extraction in Soxhlet apparatus

### 3.2 Methods

#### 3.2.1 Procedure

The solvent is heated to reflux. The solvent vapour travels up a distillation arm and floods into the chamber housing the thimble of solid. The condenser ensures that any solvent vapour cools and drips back down into the chamber housing the solid material. The chamber containing the solid material slowly fills with warm solvent. Some of the desired compound dissolves in the warm solvent. When the Soxhlet chamber is almost full, the chamber is emptied by the siphon. The solvent is returned to the distillation flask. The thimble ensures that the rapid motion of the solvent does not transport any solid material to the still pot. This cycle may be allowed to repeat many times, over hours or days. During each cycle, a portion of the non-volatile compound dissolves in the solvent. After many cycles the desired compound is concentrated in the distillation flask [23]. The advantage of this system is that instead of many portions of warm solvent being passed through the sample, just one batch of solvent is recycled (Fig. 6).



**Fig. 6 Soxhlet apparatus**

#### 3.2.2 Simple distillation procedure:

Figure 7, 8 and 9 showed the synthesis of rice bran oil through distillation process. The extracted solvent in the round bottom flask is heated by using the heating mantle. The heating mantle is kept at 60 – 70 degree Celsius. The round bottom flask is connected with a L bend. The L bend is connected with the condenser, where we can separate the hexane from the oil.



**Fig. 7 Simple Distillation setup.**



**Fig. 8 Oil mixed with solvent**



**Fig. 9 Extracted rice bran oil**

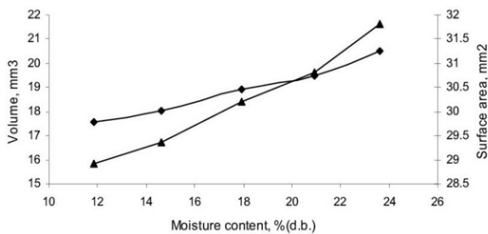
## 4. Results and discussion

### 4.1 Moisture

Figure 10 shows that water or other liquid diffused in a small quantity as vapour, within a solid, or condensed on a surface and its percentage is about 0.5-1.0% (Table 1)

**Table 1 Rice bran oil properties such as volume and surface area**

	Volume (mm <sup>3</sup> )	Moisture content (%)	Surface area (mm <sup>2</sup> )
16	17.5	12	29
6.5	18	15	29.5
7.5	18.5	18	30
9.5	19.5	21	30.7
20	21	24	31.2



**Fig. 10 Effect of Moisture content of Rice bran oil on volume and surface area**

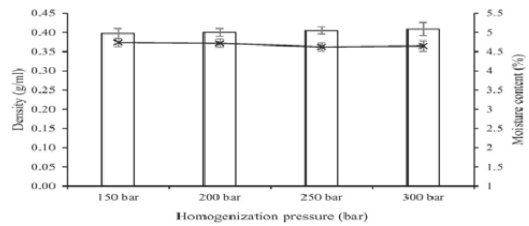
Moisture is the amount of water present in edible oils. The amount of water should be as low as possible. The permissible limit is a maximum 0.10 % by mass.

### 4.2 Density

Figure 11 shows the effect of the homogenization pressure of rice bran oil on density and moisture content. The degree of compactness of a substance and it is found at 15°C is 0.913- 0.920 (Table 2)

**Table 2 Treated Rice bran oil density and moisture content**

Density (g/ml)	Pressure (bar)	Moisture content (%)
0.37	150	4.6
0.37	200	4.6
0.36	250	4.5
0.37	300	4.6



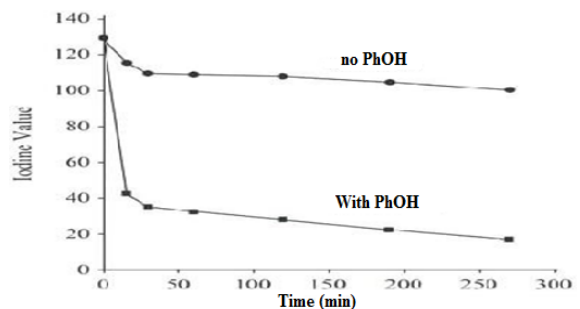
**Fig. 11 Effect of homogenization pressure of rice bran oil on density and**

### 3.3 Iodine value

Figure 12 shows the treated Rice bran oil with phenol and without phenol. It is a quality test for edible oil, and the iodine value of rice bran oil should be between 90-105 as per Indian standards (Table 3).

**Table 3 Treated Rice bran oil Iodine value with phenol and without Phenol**

Iodine value with PhOH	Iodine value without PhOH	Time (mins)
40	120	10
37	110	30
36	110	60
35	110	120
30	105	180
20	100	270



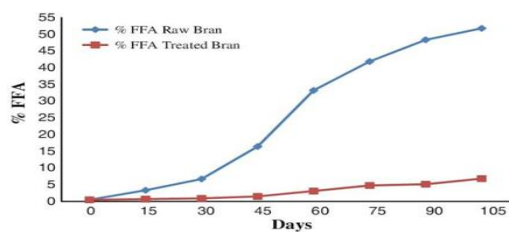
**Fig. 12 Treated Rice bran oil with phenol and without phenol**

### 3.4 Free fatty acids

It is clearly depicted that rice bran oil has palmitic acid (22.7%) as the major saturated fatty acid (Figure 13). It is high in oleic acid (43.9%), and linoleic acid in the largest component (29.6%) of or of polyunsaturated fatty acids, followed by low level (1.25%) linolenic acid (Table 4).

**Table 4 Free fatty acid content of treated and untreated rice bran oil under aging conditions**

fatty acids	Treated	No.of Days
0	0	0
4	1	15
6	2	30
15	3	45
35	4	60
45	5	75
50	6	90
52	6	105



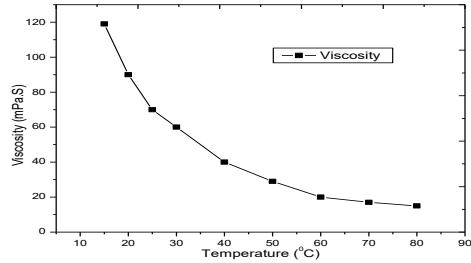
**Fig. 13 Free fatty acid content in treated and raw Rice bran with number of days**

**3.5 Viscosity**

Figure 14 shows that the effect of temperature on viscosity of various natural and synthetic oil. It is found that 0.0398 Pa·s Rice bran oil was the most viscous (0.0398 Pa·s at 38°C) while walnut oil was the least viscous (0.0296 Pa·s at 38°C) among the oils studied (Table 5).

**Table 5 Treated rice bran oil viscosity at different temperatures**

Temperature (°C)	Viscosity (mPa.S)
15	119
20	90
25	70
30	60
40	40
50	29
60	20
70	17
80	15



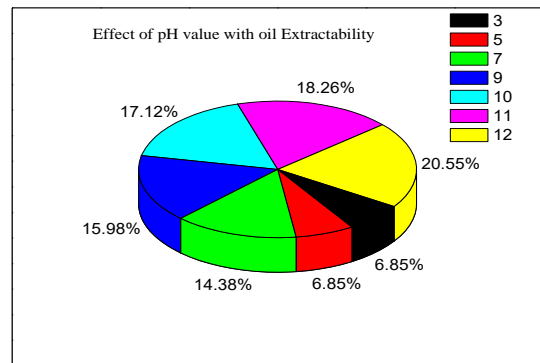
**Fig. 14 Effect of temperature on viscosity of rice bran oil.**

**3.6 P<sup>H</sup> value**

Figure 15 shows that the fully parboiled rice bran oil has a nearly neutral pH level of 6.9 after minimum days of storage (Table 6). The minimum level of pH has found on the un-parboiled rice bran oil which is 3.10 after one week of storage.

**Table 6 P<sup>H</sup> value of Treated rice bran oil**

pH Value	Oil Extractability (%)
3	30
5	30
7	63
9	70
10	75
11	80
12	90



**Fig. 15 Effect of pH value with oil Extractability**

## 5. Conclusion

Rice bran oil offers many benefits and is an excellent choice for gaining nutrition. The oil contains vitamins such as B and E, proteins, fatty acids, antioxidants, collagen, elastin, oryzanol and ferulic acid. Antioxidants and Vitamin E are good for the heart as they reduce the amount of bad cholesterol and prevent cardiac arrest. Compounds such as oryzanol and ferulic acid are used as functional food supply ingredients. Apart from these benefits, the consumption of rice bran oil maintains the immune system, aids in weight loss, prevents diseases like cancer, relieves symptoms of menopause and enhances skin health. These advantages motivate capitalists to venture into rice bran oil manufacturing and thus can supply cooking oil and various other essential products that require rice bran oil as a component of it. Is. Although it is classified as an “oil”, rice bran oil is completely safe for consumption by patients with heart problems, diabetes, cholesterol, or high blood pressure. Because of all these benefits, you can expect good profits in the Rice Bran Oil Making Business.

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