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A RIEVEW OF COMPARATIVE STUDY OF RICE BRAN OIL AND RICE BRAN WAX

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ABSTRACT

Rice bran wax is a natural vegetable wax and is a value added by product of Rice bran oil refineries. According to the Indian Council of Medical Research. Rice bran oil has an almost balanced fatty acid composition that is close to this ratio. Rice bran oil is rich in monounsaturated and polyunsaturated fats and free of trans-fats. It is wildly useful in the house hold and medical purpose, while Rice bran wax used in many general industries. In the present review article it is clear that this article include the specification of rice bran oil /wax. It is also used by food industries; it has very good potency to be used in pharmaceutical and cosmetic industries as a emulsifier. RBO also reduces the cholestrol level and use ful in the heart diseases problems. It can replace partially in most of the products and the region wise area, production and productivity in the Maharashtra State also mentioned the statistical data.

Key words: Rice bran, Rice bran oil, Rice bran wax, Gamma oryzanol.

INTRODUCTION

Rice, a monocot, is normally grown as an annual plant, the rice plant can grow about 1–1.6 m (3.2–5.8 ft) tall, occasionally it will be depending on the variety and soil fertility. It has long,[1] The small wind-pollinated flowers are produced in a branched arching to pendulous inflorescence 32–48 cm long. However, rice can be grown practically anywhere, even on a steep hill or mountain area with the use of water-controlling terrace systems. Although its parent species are native to Asia and certain parts of Africa, centuries of trade and exportation have made it commonplace in many cultures worldwide. Maharashtra is located in the western part of India along the Arabian Sea. It lies between 15° 44' to 22° 6' N and 72° 36' to 80° 54' E. [2] The total area of Maharashtra State is 306,000 square kilometers, which is 9.36% of the country. Considering the area and population, Maharashtra state is the third largest state in India. [3] The population of the state is 80 million which is 9.47% of the country's total population In Maharashtra rice is the second important crop of the people, which is grown over an area of 14.99 lakh hectares with an annual rough rice production of 32.37 lakh tones. The average productivity of the state is 2.01 t/ha. Maharashtra ranks 13th place in rice production in country. The name wild rice is usually used for species of the genera *Zizania* and *Porteresia*, both wild and domesticated, although the term may also be used for primitive or uncultivated varieties of *Oryza*

Rice bran oil

What is Rice bran oil

Rice bran oil is the oil is extracted from rice husk with high smoke point of 232 °C (450 °F) and its mild flavor, making it suitable for high-temperature cooking methods such as stir frying and deep frying. It is popular as a cooking oil in several Asian countries, including Japan, India and China, Bangladesh. Rice bran oil is less expensive non-conventional oil and it improve the more stability of the blended oil due its nutrient composition.[5] The commonly used for rice bran oil (RBO) extraction Refining improving quality (flavor and color) , stability, and fatty acid composition, vitamins and antioxidants The common chemical RBO refining process includes neutralization,[6] bleaching, degumming, dewaxing and deodorization neutralization removed free fatty acids by precipitation with a sodium hydroxide solution and the sodium salts of the free fatty acids (soaps) are separated by centrifugation and Degumming process removes phospholipids and lipoproteins, through hydration, by adding water and either citric or phosphoric acid, followed by centrifugation [7].

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The pigments naturally present in the crude oil like carotenoids and chlorophylls are removed by adsorption on bleaching earth during dewaxing, the oil is maintained at low temperatures to provoke wax crystallization;[8] then solidified waxes are removed by filtration or centrifugation Finally, during deodorizing, volatile substances that are responsible for undesirable odors are removed; for this purpose, the oil is heated to198–240˚C at low pressures (3–5 mm Hg). Bran is the hard outer layer of grain and consists of aleurone, germ, pericarp and a part of endosperm.[9] When bran is removed from grains, the grains lose a portion of their nutritional value.

- ✓ Bran is characterized by its high fat and protein content along with vitamins, minerals and many other useful chemicals.
- ✓ Bran removal amounts to 4% to 9% weight of the paddy milled.

Composition of RBO [10]

Composition of RBO is similar to that of peanut oil, consisting 37% polyunsaturated, 38% monounsaturated, and 25% saturated fatty acids. The fatty acid composition is.

USE OF RICE BRAN

- ✓ Edible oil
- ✓ Industrial crude oil
- ✓ Free fatty acid
- ✓ Plasticizers
- ✓ Tocoferol
- ✓ Rice bran wax

Edible grade oil

Rice bran oil has a very low content of linolenic acid with high content of tocopherol. [11] It has distinct advantages over other vegetable oils Different grades of bran oil such as alad oil, Cooking oil, Shortenings. could be produced by hydrogenation and refining.

Industrial grade crude oil

Protective coatings

Rice bran oil can be used to manufacture surface coatings like resin based paints, enamels, varnishes and lacquers (a clear or coloured varnish) etc.

Free fatty acid manufacture

stearic and oleic acid cav also be manufacture by Bran oil.

Soap manufacture

Rice bran oil contain high Free Fatty Acid (FFA) which is suitable for the manufacturer of soft soap and liquid soap. [12] In addition, other soaps like aluminum, barium and calcium soaps can be manufactured.

Plasticizers

Bran oil can also be used to manufacture plasticizers for use in plastic and rubber industries

Tocoferol

Crude bran oil contains 2-4% tocoferol which has nutritional and antacid effects, [13] The oryzanol content of the pan heated rice bran oil samples remains approximately the same even when heated at 180˚C for 8 hours.

Health benefits

A component of rice bran oil is the antioxidant γ-oryzanol, at around 2% of crude oil content. [14]Thought to be a single compound when initially isolated, it is now known to be a mixture of sterol and other triterpenyl esters of ferulic acids. [15] Also significant is the relatively high fractions of tocopherols and tocotrienols, together as vitamin E. Rice bran oil is also rich in other phytosterols.

Rice bran Wax (RBW)

What is Rice bran Wax

Hard yellowish to brownish wax from leaves of the carnauba palm used especially in floor waxes and polishes is a good substitute carnauba wax. It can also be used as component in formulations like stencils, candles ,carbon paper base etc.[17] Rice bran wax is waste material of dewaxing process in oil refining.[18] Dewaxing is accomplished by mean cooling and filtrating for separating wax from the oil to avoid turbidity in the final product. The dewaxing residue may have 20 up to 80 wt% of oil, followed by a main fraction of waxes, free fatty alcohols, free fatty acids and hydrocarbons. Rice Bran Wax has broad application in a wide variety of foods as a thickener, binding agent, plasticizer, cosmetics, coating and gelling agent. RBW primarily consists of high molecular weight monoesters ranging from C-46 to C-66. Our domestically refined Rice Bran Wax is not solvent extracted, and is rendered of its color using natural carbons and clays. [19]

Chemical Composition of BBW

The main components of rice bran wax are aliphatic acids (wax acids) and higher alcohol esters. The aliphatic acids consist of behenic acid (C22), lignoceric acid (C24), palmitic acid (C16), other higher wax acids. The higher alcohol esters consist mainly of ceryl alcohol (C26) and melissyl alcohol (C30). [20] Rice bran wax also contains constituents such as free fatty acids (palmitic acid), squalene and phospholipids.

USES

It is used in paper coatings, textiles, explosives, fruit & vegetable coatings, pharmaceuticals, candles, molded novelties, electric insulation, textile and waterproofing, leather sizing, typewriter ribbons, printing inks, carbon paper, adhesives, chewing gum, lubricants, crayons and cosmetics.[21] In cosmetics, rice bran wax is used as an emollient, and is the basis material for some exfoliation particles. It has been observed that rice bran wax at concentrations as low as 1 wt% in triglycerides can crystallize to form stable gels.

CHARACTERIZATION OF RICE BRAN WAX (RBW)

Melting Point [22]

Finely powdered RBW at a temperature considerably below its melting point. Transferred a portion to a dry capillary tube and packed the powder by tapping on a hard surface so as to form a tightly packed column 4 to 8 mm in height. Attached one of the tubes to a thermometer graduated in 0.5°C so that the substance is close to the bulb of the thermometer. Introduced the thermometer with the attached tube into a beaker so that the distance between the bottom of the beaker and the lower part of the bulb of the thermometer is 1 cm. fill the beaker with water to a depth of 5cm. Increased the temperature of the water gradually at a rate of 1 c/min.

Specific Gravity

Dry the pycnometer that previously has been calibrated by determining its weight and the weight of recently boiled water contained in it at 25°C. Melted the substance and filled the pycnometer with it.[23] Adjusted the temperature of filled pycnometer to 25°C and weighed. The specific gravity is the quotient obtained by dividing the weight of sample contained in the pycnometer by the weight of water contained in it, both determined at 25°C.

Moisture Content

Standardization of the reagent

Placed about 34 ml of dehydrated methanol in the titration vessel and added sufficient KF reagent to give the characteristic end-point. Added quickly 150 to 350 mg of sodium tartrate accurately weight by difference and titrated to end-point.[24] The water equivalence factor F in mg of water per ml of reagent is given by the formula

$$Factor = \frac{\text{Wt of D.s.T} \times 0.1566}{\text{B.R}}$$

Procedure

After determination of factor added 0.5 g RBW accurately to the titration vessel. [25] Stirred for 1 minute and titrated against the electrometric end-point using KF reagent.

$$Moisture\ content = \frac{\text{B.R.} \times \text{Factor} \times 100}{\text{Wt of sample.}}$$

Saponification Value

Weighed 2 g of the RBW into a 200 ml flask, added 40.0 ml of the ethanolic solution of potassium hydroxide and boiled under a reflux condenser for 2 hour, rotating the contents frequently. While the solution was hot,[26] titrated the excess of alkali with 0.5 M Hydrochloric acid using phenolphthalein solution as indicator. Repeated the operation without RBW. [26] Calculated the Saponification Value from the expression 28.05 v/w where v is the difference, in ml, between the titrations and w is the weight, in g, of substance taken

$$Sap\ Value = \frac{28.05 \times \text{Diff.}}{\text{Wt. of sample.}}$$

Acid Value

Dissolved 10.00 g of RBW in 50 ml a mixture of equal volumes of ethanol (96 %) and light petroleum, previously neutralized with 0.1 M sodium hydroxide, using 0.5 ml of phenolphthalein solution as indicator. [28] Heated to about 90°C to dissolved the RBW. When the substance has dissolved, titrated with 0.1 M sodium hydroxide until the pink color persists for at least 15s (n ml of titrant). When heating has been applied to aid dissolution, maintained the temperature at about 90°C during the titration

$$Acid\ value = \frac{5.610 \times \text{n}}{\text{Wt. of sample}}$$

Ester Value

The ester value calculated by following formula;

$$Ester\ value = Sap\ value - Acid\ value.$$

Hydroxyl Value

2.0 gm of RBW into a 150 ml acetylating flask fitted with an air condenser. Add 5 ml of acetic anhydride solution and attached the air condenser. Heated the flask in a water- bath for 1 h keeping the level of the water about 2.5 cm above the level of the liquid in the flask.[29] Withdrawn the flask and allowed it to cool. Add 5 ml of water trough the upper end of the condenser. Added sufficient pyridine to clear cloudiness and the volume added was noted. Shaken the flask and replaced it in the water-bath for 10 min.[30] Withdrawn the flask again and allowed to cool. Rinsed the condenser and the walls of the flask with 5 ml of alcohol, previously neutralized to phenolphthalein solution. Titrated with 0.5 M alcoholic potassium hydroxide using 0.2 ml of phenolphthalein solution as indicator (n2 ml of 0.5 M alcoholic potassium hydroxide). Carried out a blank test under the same conditions (n2 ml of 0.5 M alcoholic potassium hydroxide)

$$Hydroxyl\ Value = \frac{28.05 \times (\text{n2} - \text{n1})}{\text{Wt of sample}} + \text{Acid value.}$$

Unsaponifiable Matter

To 2.0 to 2.5 g of RBW contained in a 250 ml flask, added 25 ml of 0.5 M ethanolic potassium hydroxide and boiled under a reflux condenser in a water bath for 1 hour, swirling the contents frequently. Washed the contents of the flask into a separating funnel with the aid of 50 ml of water and while the liquid was slightly warm, extracted by shaking vigorously with three 50 ml quantities of peroxide free ether, rinsing the flask with the first quantity of ether. Mixed the ether solutions in a separating funnel containing 20 ml of water. Gently rotated separating funnel for a few minutes without violent shaking, allowed the liquids to separate and discarded the aqueous layer. [31] Washed the ether solution by shaking vigorously with two 20 ml quantities of water and then treated with three 20 ml quantities of 0.5 M potassium hydroxide, shaking vigorously on each occasion, each treatment was followed by washing with 20 ml of water. Finally washed with successive 20 ml quantities of water until the aqueous layer was no longer alkaline to phenolphthalein solution. Transferred the ether extract to a weighed flask rinsing the separating funnel with peroxide free ether, distilled the ether and added 3 ml of acetone to

the flask.[32] With the aid of a gentle current of a air removed the solvent completely from the flask which was almost immersed in boiling water and hold obliquely and rotated. Dried to constant weight at a temperature not exceeding 80° C and dissolved the content of the flask in 10 ml of freshly boiled ethanol (96 %) previously neutralized to phenolphthalein solution. Titrated with 0.1 M ethanol sodium hydroxide using phenolphthalein solution as indicator. Calculated the Unsaponifiable matter as a percentage of the substance.

$$Unsaponofied\ matter = \frac{\text{Wt of Resisdue} \times 100}{\text{Sample.}}$$

Free Fatty Acid [30]

Boiled 250 ml of ethanol (96 %) to remove carbon dioxide, added 0.5 ml of phenolphthalein solution, allowed to cool to 70°C and neutralized with 10g Sodium hydroxide to 100 ml of the neutral ethanol, added 10 g of the RBW and dissolved it quickly by heating under a reflux condenser.[29] Cooled to 70°C and titrated at 70°C with 0.1 M sodium hydroxide (Not more than 0.2 ml is required. If the solution is still pink added in a thin stream 5 ml of hot barium chloride solution previously neutralized to phenolphthalein solution, mix thoroughly and titrate with M hydrochloric acid until the pink color disappears not more than 1.0 ml is required).

Iodine Value

Taken 1.0 g substance into a 250 ml flask fitted with a ground glass stopper and previously dried or rinsed with glacial acetic acid, and dissolved it in 15 ml of chloroform.[27] Added very slowly 25.0 ml of iodine bromide solution. Closed the flask and kept it in the dark for 30 min. shaking frequently. Added 10 ml of a 100 g/l solution of potassium iodide and 100 ml of water. Titrated with 0.1 M sodium thiosulphate shaking vigorously until the yellow color was almost discharged. Added 5 ml of starch solution and continued the titration by adding the 0.1 M sodium thiosulphate drop wise until the color was discharged (n1 ml of 0.1 M sodium thiosulphate). Carried out a blank test under the same condition (n2 ml of 0.1 M sodium thiosulphate).

$$Iodine\ value = \frac{1.269 \times (n2 - n1)}{\text{Wt. of sample.}}$$

MEDICINAL IMPORTANCE OF RBO/RBW [29]

1. Menopause relief: A study found that 90% of women taking rice bran oil daily found relief in menopausal symptoms be because Y-oryzanol, a compound present in rice bran oil, is believed to be effective in curbing hot flashes and other symptoms of menopause.

2. Heart disease reduces fortune oil (RBO)

- ✓ Cholesterol lowering oil
- ✓ Oryzanol: Improves HDL/LDL ratio. Healthier heart.
- ✓ Balanced PUFA/MUFA ratio: Cleaner blood vessels.
- ✓ Balanced Fatty Acids : Balanced nutrition, balanced health.
- ✓ Tocotrienols & Phytostrerols: Anti-cancer properties.
- ✓ Squalene: Improves skin tone and delays wrinkle formation.
- ✓ Vitamin E: Helps maintaining balance of nervous system**.**
- ✓ Natural antioxidants: Protection against diseases.
- ✓ Ferulic acid: Stimulates hormonal secretion, rejuvenates health.
- ✓ Low oil absorption: Healthier food.

3. Cholestrol level: Rice bran contains 10–23% oil and negligible amounts of water-soluble β-glucans and larger amounts of insoluble dietary fiber. Because of these differences, it is believed that rice bran lowers cholesterol by a mechanism different from that of oat bran. Decreases in cholesterol were found in hypercholesterolemia subjects who replaced their usual cooking oils with rice bran oil and in middle-aged and elderly subjects consuming a low-fat diet containing rice bran oil.

4. Cancer protection: Rice bran oil is a rich source of tocopherols and tocotrienols, both of which are anti-mutagenic in nature. These substances help prevent cancer caused by free radicals.

5. Better cardiovascular health: Rice bran oil, on the other hand, contains oryzanol, which helps reduce blood cholesterol levels, blood clotting and thereby prevents many heart diseases like congestive heart failure, heart attack etc.

6. Improved skin health: Squalene, a compound present in rice bran oil, works wonders in improving skin health. It acts like a natural moisturizer, prevents the formation of wrinkles and delays skin ageing. It also protects the skin from sun damage and helps improve healthy skin tone.

7. Immunity boost: Rice bran oil can act as an effective immune system booster. Regular consumption of foods cooked in rice bran oil helps the body fight free radicals and improves its ability to fight against diseases.

8. Endocrine power: The vitamin E content in rice bran oil is believed to work wonders in improving endocrine system function by balancing hormonal release.

Table 1. Shows the region wise area, production and productivity in the State are as below.

Sr. No	Region	Area (lakh ha)	Rice production (lakh tones)	Rice productivity (t/ha)
1	Konkan	4.136	10.42/15.10	2.56/3.65
2	West. Maharashtra	3.298	6.08/8.82	1.85/2.67
3	Marathwada	0.242	0.10/0.14	0.42/0.59
4	Vidarbha	7.319	5.73/8.31	0.78/1.14
5	Total	14.995	22.34/32.37	1.39/2.01

Table 2. Official Specification of Rice [4]

Nutritional value Per 100 g (3.5 oz)	
Energy	1,527 kJ (365 kcal)
Carbohydrates	80 g
Sugars	0.12 g
Dietary fiber	1.3 g
Fat	0.66 g
Protein	7.13 g
Vitamins	
Thiamine (B1)	(6%) 0.0701 mg
Riboflavin (B2)	(1%) 0.0149 mg
Niacin (B3)	(11%) 1.62 mg
Pantothenic acid (B5)	(20%) 1.014 mg
Vitamin B6	(13%) 0.164 mg
Trace minerals	
Calcium	(3%) 28 mg
Iron	(6%) 0.80 mg
Magnesium	(7%) 25 mg
Manganese	(52%) 1.088 mg
Phosphorus	(16%) 115 mg
Potassium	(2%) 115 mg
Zinc	(11%) 1.09 mg
Water	11.61 g

Table 3. Specification of Rice Bran Oil. (RBO)

Rice Bran Oil	
Fat composition	
Saturated fats	
Total saturated	25% Myristic: 0.6% Palmitic: 21.5% Stearic: 2.9%
Unsaturated fats	
Total unsaturated	75%
Monounsaturated	38%
Oleic acid	38%
Polyunsaturated	37%
Omega-3 fatty acids	α-Linolenic: 2.2%
Omega-6 fatty acids	Linoleic: 34.4%
Properties	
Food energy per 100 g (3.5 oz)	3,700 kJ (880 kcal)
Smoke point	232 °C (450 °F)
Iodine value	99-108
Acid value	1.2
Saponification value	180-190
Unsaponifiable	3-5

Table 4. Composition of RBO

Fatty acid	Percentage
C14:0 Myristic acid	0.8%
C16:0 Palmitic acid	21.5%
C18:0 Stearic acid	2.8%
C18:1 Oleic acid (an Omega 9 fatty acid)	38.4%
C18:2 Linoleic acid (LA, an Omega 6 fatty acid)	32.4%
C18:3 α-Linolenic acid (ALA, an Omega 3 fatty acid)	2.1%

Table 5. Properties of Rice bran oil and Refined oil [16]

Character	Crude Rice bran oil	Refined oil
Moisture	0.5-1.0%	0.1-0.15%
Density (15-15 °C)	0.913-0.920	0.913-0.920
Refractive Index	1.4672	1.4672
Iodine value	95-100	95-104
Saponification value	187	187
Unsaponifiable matter	4.5-5.5	1.8-2.5
Free fatty acids	5-15%	0.15-0.2%
oryzanol	2.0	1.5-1.8
Tocopherol	0.15	0.05
Color	20Y+2.8R	10Y+1.0R

Table 6. Physical Properties of RBW name: *Oryza Sativa (Rice) Bran Wax*.

S/No	Physical Properties	Observation
1	Melting point	77 - 86 °C
2	Saponification value	75 – 120
3	Acid Value	≤13
4	Iodine number	11.1 - 17.
5	Concentration Used	1-20%
6	Free fatty acids	2.1 - 7.3%
7	Phosphorus	0.01 - 0.15%
8	Color	Off-white, orange/brown
9	Odor	typical fatty, crayola-ish
10	Applications	binding agent, plasticizer, coating and gelling agent.

Figure 1. Picture of Rice.

Figure 2. RBO

Figure.3. Fortune oil

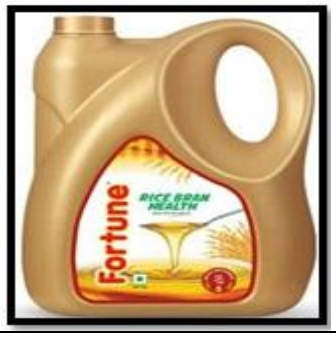
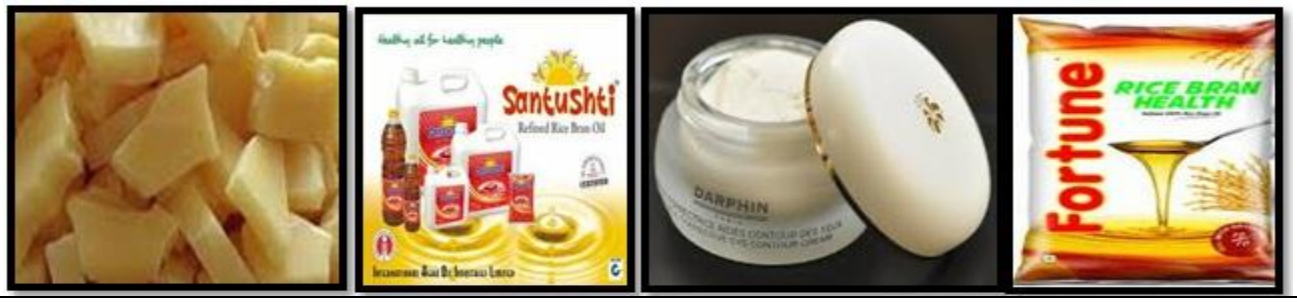


Figure 4. MARKETED PREPARATION OF RBO/RBW



CONCLUSION

According to the Indian Council of Medical Research. Rice bran oil has an almost balanced fatty acid composition that is close to this ratio. Rice bran oil is rich in monounsaturated and polyunsaturated fats and free of trans-fats. It is wildly useful in the house hold and medical purpose, while Rice bran wax used in many general industries. It is also used by food industries; it has very good potency to be used in pharmaceutical and cosmetic industries as a emulsifier. RBO also reduces the cholesterol level and use ful in the heart diseases problems. It can replace partially in most of the products.

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