RICE BRAN OIL-AN IMPORTANT FUTURE SOURCE FOR EDIBLE AND ESSENTIAL OILS IN ORISSA

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ABSTRACT

Present crisis of edible and essential oils has been critically reviewed with special reference to the state. Rice bran oil has been suggested as an answer to this problem. The composition and uses of rice bran and the rice bran oil have been detailed. Process steps along with flow diagrams have been elaborated for the production of crude and refined rice bran oil- . Importance of rice bran oil industry in the state has been outlined.

Introduction

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. 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 facts both for edible and non-edible purposes, But the increase in the production of oil seed crop 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. 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.

In India, again if we review the situation province-wise, we find that Orissa has been worst affected by this problem. Oil-based industries like the hydrogenation, soap, paint and fine chemical industries have not been developed to a considerable extent. This is mainly because of the fact that, a large portion of the cultivable land in the province is unsuitable for good growth of the oil seed crops. Production of oil seeds in Orissa is very meagre as compared to the country's production, which has been exemplified in the table below.

TABLE 1

Oil Seed Production in Orissa (In thousand tonnes)

Year	Ground nut	Castor seed	Rape seed & Mustard	Lin seed	Total (including other oil bearing seeds)	% age of country's total production.
1969-70	82.70	13.10	21.30	5.2	161.00	2.12
1970-71	83.10	16.80	21.30	5.2	230.00	2.50
1972-73	105.4	19.00	30.00	7.3	200.00	2.98

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Therefore, any proposition to recover oil from every possible sources should prove profitable. Against the panoramic dream of making Orissa self-sufficient in edible and non-edible oils. We have two propositions namely,

(i) recovery of oil from rice bran, and
(ii) Recovery of oil from oil bearing materials available in the forests of Orissa. Table 2 gives the average percentages of oil in the oil bearing materials, which are mainly the forest products.

TABLE 2

Average percentage of oil in the oil bearing materials

Name of material	percentage of oil
Karanj	27 - 39
Neem	42 - 45 *
Salseed	13 - 15
Mahua	50 - 55 *
Tobacco seed	33 - 38

(* represent oil content of meal)

Most of the above have not been commercially exploited. Of late, limited utilization of the sal seed has been possible in the state. As against this, the first 'proposition i.e. recovery of oil from rice bran has been successfully tested, tried out and can be made commercially feasible.

Composition and Uses of Rice Bran

When the brown rice is subjected to polishing, bran and polish are removed alongwith the germs. This bran is 4 to 7.5% of paddy averaging 6%. A portion of the endosperm is invariably present in the bran and the commercial yield of rice bran may be 8.5%. Thus it can be concluded that rice bran is the cutiale existing between rice and the outer husk of the paddy.

The composition of rice bran and the various vitamins present therein are given in table 3 & 4 respectively.

TABLE 3

Composition of Rice Bran

Constituents	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
Ash	9.3 — 14.3
Pentosane	8.7 — 11.4
Cellulose	11.4
Reducing Sugars	1.3
Sucrose	10.6

TABLE 4

Vitamins present in Rice Bran

Vitamins	percentage
Thiamine	27.9
Pantothenic acid	7.1
Pyridoxive	3.2
Riboflann	2.1
Biotin	0.46
Vitamin E	30

The rice bran is highly nutritious as it contains lipids, protein, minerals and vitamins. Because of its nutritional value, the rice bran has been used as a feed for poultry and livestock, it is a potential source of vegetable oil. The removal of oil from the bran does not reduce its value as stock feed, since the percentage of protein, mineral and vitamin content is increased. The defatted bran is more stable with respect to rancidity, which is a serious problem in the storage of this mill feed. In addition hard waxes of high melting points suitable for industrial uses are a byproduct of the oil extraction process. The recovery of wax improves the processing properties of the oil The various uses of rice bran has been depicted in Fig. 1.

Rice Bran Oil

Rice bran oil finds application both as edible oil and industrial grade oil. The industrial grade

oil is obtained from rice bran, by the process of extraction with petroleum solvents, whereas the edible grade oil is the one refined by neutralisation with alkali, with or without bleaching with fuller's or activated earth and/or activated carbon no other chemical agents being used. The edible grade bran oil is coloured leaf-green and is quite similar in composition and taste to groundnut oil. Special characteristics of rice bran oil is the very marked resistance to oxidative rancidity. The stabilities of the refined, bleached and deodorised rice bran oil and the hydrogenated products are approximately twice those of comparable, commercially acceptable vegetable fats.

Recovery of crude rice bran oil

The processing of rice bran to yield crude bran oil involves the following important steps (figure 2) :

1. Preparation of rice bran for extraction.
2. Extraction with solvent
3. Distillation of miscella
4. Slipping of the oil.
5. Separation of oil from water in the post-dissolventiser tank.

Preparation of rice bran is the reduction of moisture content from 12% to 6% in an expeller by steam jacketing. The treatment besides reducing the moisture content of bran, increases (he particle size and imparls a hardening effect to bran particles for better extractibility, better filtration time and reduction of fines problem. The pre-treated bran after being turned to flakes in a groundnut expeller is elevated through a bucket elevator and fed to extraction column.

The extraction can be either batch or continuous. The bran is seated on the false bottom provided in the extractor with coir mat as filter element. After maintaining a vacum of 25" Hg in the extractor, solvent normally hexane, is drawn into the extractor which is a counter-current multistage type and the extraction is carried out in hot condition, since it helps in quick and efficient extraction, the oil which gets dissolved in the solvent is withdrawn from the bottom as concentrated miscella. The solvent retained with the bran is recovered finally and reused.

The distillation of concentrated miscella is carried out at a temperature of about 75-80° C, when more volatile component, hexane vaporises leaving behind the oil. The vapours oi the solvent are condensed and reused. The oil with 4% solvent is taken from the bottom to a stripping column.

The crude oil with about 4 % solvent is fed to the stripping column, which has block of gravels placed on a perforated plate as a packed column. The oil is stripped off the solvent by open steam injecting and the solvent vapours recovered to be reused after condensation. The oil along with the condensed steam is taken by gravity into a tank called post-dissolventiser.

In the post-dissolventiser, the oil along with condensed steam from stripping column is kept for 2 to 3 hours, when water gets separated and the oil is taken to the oil tank where the oil is given salt wash to separate the sludge, gums etc. in the oil. This is the crude rice bran oil.

The crude bran oil thus obtained can be used for manufacture of soap, emulsifiers, fatty acid, plasticisers, cosmetics and tocoferol (vitamin E) etc.

Refining of crude rice bran oil for edible purposes

Rice bran oil is yet to find application as an edible oil in this country, although in some of the foreign countries, this is used as a common salad edible oil since long.

Rice bran oil is, in general not only high in acid value in crude state but contains a considerable amount of wax, unsaponifiable matter and minute ingredients as well as a large amount of colouring matter difficult to bleach, and therefore it is said to be the most difficult oil among all vagetable oils, to refine. The various steps involved in the refining as depicted in figure 3 are as follows.

Dewaxing

It is preferable to remove wax from crude oil at the first stage of refining process, otherwise yield and quality of edible oil will decrease. Among various methods available for dewaxing, continuous wax method, in which Ketones are used as solvent, is preferred to others. The yield rate of dewaxed oil is 90-93% and that of the crude wax is approximately 5-8 %.'

Degumming

This step is essential to remove gums and mucilages present in the vegetable oils which are complex mixtures. The normal method of degumming involves the use of small quantities of concentrated phosphoric acid or sulphuric acid at moderate temperatures followed by filtration or settling. Alternately, direct steam injection may be carried out until the temperature reaches 80-100° C by which time sufficient steam will have condensed to achieve hydration and flocculation of the colloidal gum materials, which are then removed by centrifugation.

Neutralisation

The purpose of this process is to remove fatty acid from dewaxed oil. In this process, the oil is treated with alkali such as caustic soda, which acts upon free fatty acid in the oil to form soap. The neutralisation is done generally either by a batch operation or by a continuous operation.

Decolorization

The decolorization is generally done either by a batch or continuous method, under either normal atmospheric pressure or vacuum. A number of studies have been carried out, all of which indicate that conventional earth bleaching will readily give oils with lovibond colours of 2-3-red units, an acceptable level for high grade cooking oil and salad oils.

Deodorization

The final stage in processing for a cooking oil involves the removal of 'oxidative breakdown products such as Ketones and aldehydes which cause undesirable odours and tastes. Deodorisation of rice bran oil can be carried out in the normal manner by heating the oil to temperatures 200-25O° C under high vacuum, stripping Out the undesirable volatiles, in a current of dry steam. Any free fatty acids, peroxides and certain proportion of natural tocopherol antioxidents are also removed. This completes refining.

The refined oil can be used as cooking oil and salad oil and also for hydrogenation purposes.

Importance of rice barn oil industry in Orissa

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.

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FIG.1: USES OF RICE BRAN

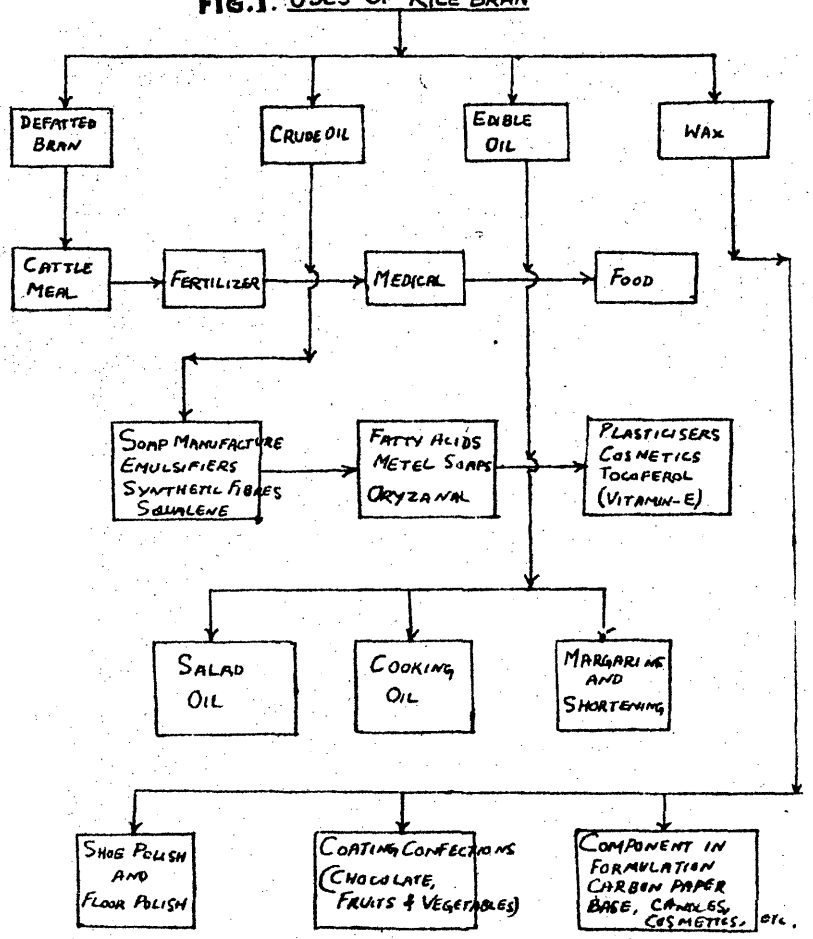
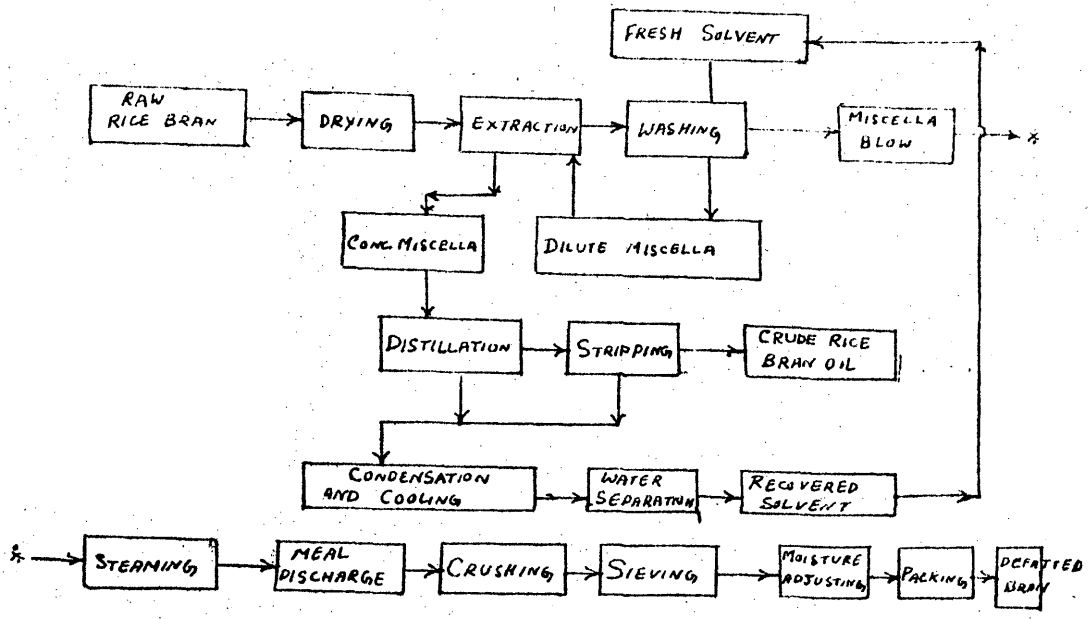


Fig. 2



SOLVENT EXTRACTION FLOW CHART OF RICE BRAN
(BATCH SYSTEM)

FLOW SHEET FOR PROCESSING RICE BRAN OIL

FIG. 3: FOR EDIBLE PURPOSES