

## CHAPTER 2

### RICE BRAN AND OIL



A clear definition of rice bran would be " The outer layer of the endosperm below the husk and the germ ". As against this the so-called commercial bran may be contain a variety of ingredients such as husk, silica sand and broken rice. Depending on the quantity of bran removed from the grain and the admixture of impurities, the oil content will also vary largely under different milling conditions in different countries.<sup>(5)</sup>

The bran, which constitutes about 8.5% on the average of the whole grain, is highly nutritious owing to its content of lipids, protein, minerals and vitamins. Because of the nutritional value of rice bran it has been used as a feed for poultry and livestock. However, in addition to its value as a feedstuff, rice bran constitutes from 14-18% of an oil with properties similar to those of cottonseed oil.<sup>(1,2)</sup> Moreover, the removal of the oil from the bran should not impair its value as a stock feed since the protein, mineral, and vitamin contents are correspondingly increased percentagewise. The de-oiled bran should prove to be more stable with respect to rancidity, which is a serious problem in the storage of this mill feed. In addition crude wax, soda-foots and scum oil are by products of the refining process. Crude wax can be further processed into high quality refined wax<sup>(2)</sup> comparable to curnauba wax. Soap stock(Soda foot) can be either directly decomposed by sulfuric acid to obtain dark oil, which is a mixture composed mainly of free fatty acids and neutral oil, or once perfectly saponified, decomposed into free fatty acids. Scum oil is sometimes utilized after suitable treatment, in blended feed stuffs for live-stock.

## 2.1 HISTORY

In Louisiana in 1905, the first attempt to industrially utilize oil from rice bran by pressing was investigated but because of the lack of market this venture proved uneconomical.<sup>(6,16)</sup> Later in Italy in 1917, rice bran oil was produced by pressing and the product was employed in soap making.<sup>(17)</sup> In the Philippine Islands in the early thirties, West and Cruz produced and prepared rice bran for human food uses,<sup>(2,18)</sup> slightly later in Japan, Ueno experimentally investigated the preparation and use of rice bran oil for food uses from hydrogenation of the oil and its utilization in both soap-making and cosmetic formulations.<sup>(2)</sup> At about the same time, Auriol in France<sup>(19)</sup> published results comparing the process of pressing with that of solvent extraction. In more recent days, advanced technology applied to the preparation of rice bran oil and its products and modifications of the oil has resulted in scientific reports by American Investigators.<sup>(2)</sup> At present the countries in which the rice bran oil industry is currently in existence are Japan, USA, Chile, Burma, Brazil, India and Thailand.

### 2.1.1 COMPOSITION OF RICE BRAN

Husked or hulled rice (brown or cargo) contains from 2 to 3 % of oil. Oil is located in the germ and in the other layers of the grain. Compositions of several rice bran samples are shown in table 2.1

### 2.1.2 COMPOSITIONS OF DEFATTED BRAN

WATER	10.0 - 12.0 %
OIL-CONTENT	01.0 - 01.5 %
CRUDE-PROTEIN	17.0 - 20.0 %
N(TOTAL NITROGEN)	02.0 - 03.0 %
K(POTASSIUM)	01.5 - 02.5 %
FIBRE	10.0 - 11.0 %
ASH	10.0 - 13.0 %
NITROGEN FREE	40.0 - 46.0 %
P(PHOSPHORIC)	5.0 %



TABLE 2.1  
COMPOSITION OF RICE BRAN \* (3)

WATER	PROTEIN	FAT	N-Free	FIBER	ASH	PENTOSANS	CELLULOSE	Reducing Sugars	SUCROSE
9.6	13.4	10.7		11.7	10.6	10.0			
9.4	12.8	15.1		12.5	11.3	11.4			
8.9	12.8	13.4	41.1	13.0					
10.3	11.6	16.2		9.6	14.3				
11.1	10.6	10.6		10.1	20.6				
10.1	12.1	11.4	44.3	12.4	9.7				
14.7	12.9	22.4			9.3	8.7	11.4	1.3	10.6
11.7	12.5	19.8	39.3	6.3	10.4				
9.8-11.0	11.5-15.0	12.7-15.4			8.0-10.0		5.0-12.0		
9.6-11.8	13.4-14.0	15.2-20.4			7.8-10.2		-		
10.7	12.1	13.0			8.9		5.9		

The values of this table are given in percent by weight of raw rice bran

### 2.1.3 CHEMICAL CHARACTERISTICS OF RICE-BRAN OIL

CLASSIFICATION	: SEMI-DRY OIL
SPECIFIC GRAVITY	: 0.912 - 0.927 (15°C)
REFRACTIVE INDEX	: 1.465 - 1.467 (40°C)
SAPONIFICATION VALUE	: 192 - 175
IODIDE VALUE	: 92 - 115
R.M.V.	: 0.59 - 1.75
UNSAAPONIFICATION MATTER	: 3.0 - 8.0 %
CALORIC VALUE (Cal/gm)	: 9438
ACID VALUE	: 5.0 - 120.0

(Note. use hexane as solvent in process)

### 2.2 UTILIZATION OF OIL

The principal use and market for rice bran oil are for edible purposes particularly in the manufacture of shortening, cooking oils, and salad oil. It is reported that refined and winterized oils are superior for mayonnaise, salad dressings and other emulsified products. Tests have indicated that rice bran oil imparts a more golden color to foods, such as shrimp, chicken, onion rings and fish and the absorption of fats is far less.

A special use of rice bran oil had been as a pan released in bakery operations. Rice-bran oil had been employed also in quick-drying, anti-rust coatings. This has been attained by combining rice oil with a drying agent. It is intended to loosen rust on a surface already rusted and to fully protect an unrusted surface.<sup>(20)</sup>

Rice bran oil has been employed as a mold-release agent by steel companies, ship builders, and gas pipe/line contractors. Reluctance of manufactures and users to fully disclose the specific uses of rice bran oil limits a fuller discussion on its utilization.

### 2.3 UTILIZATION OF THE BY-PRODUCTS

Crude wax, soda-foots and scum oil are by-products of



the refining process. Crude wax can be further processed into a high-quality refined wax. Rice wax is a possible replacement for imported vegetable waxes in many purposes. The United States, for example, imports practically all the hard vegetable waxes it uses in polished, carbon paper, food wraps and vegetable coatings, and for the past 15 years the imports have amounted to over 20,000,000 pounds per year. It is reasonable to predict, on the basis of the properties of rice bran wax and upon preliminary testing in actual formulations, that rice bran wax would be a desirable article of commerce and could replace carnauba wax to a great extent, subject, of course, to its economical production.<sup>(2)</sup>

Soap stock(soda-foots) can be either directly decomposed by sulfuric acid to obtain dark oil, which is a mixture composed mainly of free fatty acids and neutral oil, or once perfectly saponified, decomposed into free fatty acids.

Scum oil is sometimes utilized, after suitable treatment in blended feed stuffs for live-stock.

In most of the Asian countries, bran is utilized largely as a feed stuff and to a small extent as a fertilizer. The problem of rancidity developing in the consequent deterioration in quality are points to be emphasized. Scientists recognize the fact that the defatted bran is a better feed stuff, that it is easier to keep than raw bran. However, this important fact has to be popularized among the farmers and those engineers in the manufacture of compound feed stuffs. Regarding the development of the rice bran oil industry, it should be noted that the defatted bran constitutes 80 % of the product. It is therefore essential that this product should be put to maximum economic advantage and marketed as such; otherwise, extraction of the oil may not be worth while. A unit quantity of defatted bran sells at a higher price than raw rice bran in Japan. India exports substantial quantities of defatted bran. In China(Taiwan) and Thailand, it is used in the manufacture of compound feed

stuffs. In some countries where rice bran oil is being produced, the marketing of defatted bran is reported to be a problem. The long-term solution would undoubtedly lie in the maximum utilization of all available protein resources within the developing countries and, to this end, there should be a growing awareness of the need to set up the manufacture of compound feeding stuffs or balanced rations for livestock. The group considered it necessary to stress the importance of marketing defatted bran when considering the possibility of rice bran-oil production, also vital is the proper desolventization of the defatted bran, this requires efficient control of operating conditions so that the feed value, colour etc, are not impaired. The bran should be pulverized to ensure uniformity of the end product. The moisture, sand silica contents should be kept within acceptable limits. These are all important points in evaluating the defatted bran as a feed stuff.