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# COMPARISON OF OIL CONTENTS OF RICE BRAN OF DIFFERENT VARIETIES AND TO STUDY THE EFFECTS OF TEMPERATURE AND ANTIOXIDANT ON FREE FATTY ACID AND PEROXIDE VALUES

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Out of the three solvents tried in soxhlets extractor for the separation of oil from rice bran, isopropanol was found better than n-Hexane and Pet. ether (40–60°C). Among the rice varieties, the best yield was given by Kernal Basmati followed by Desi Basmati, Jhona and Irri-Pak bran. The optimum temperature for predrying the bran was 100°C for one hour, where Free fatty acid (F.F.A.) Value was 5.43 and the lowest Peroxide (P.O.) Value was 2.75 with the use of antioxidant.

## INTRODUCTION

Pakistan at present produces 326.3 thousand tons of vegetable oils annually (1979) against the estimated requirement of 630.3 thousand tons and this gap is ever on the increase due to rapidly increasing human population. Industries like those of paints, soap and lubricants also depend upon vegetable oils. Among the non-conventional resources of edible oils which can add up to the annual output of this commodity, rice bran and rice polish, obtained during the milling process of paddy rice, represents 10 per cent of the total rough rice. The annual production of rice in Pakistan is about 4,322900 tons (1978). Ten percent bran and polish from this paddy rice produces 432290 tons of bran, and an average 15 per cent (14 to 17 per cent) extracted oil from this agricultural waste amounts to 64843.3 tons of oil.

The principal obstacle to the production and utilization of the oil is its reputedly low quality. The crude oil has a high content of free fatty acid and it is difficult to bleach and refine. After milling an extremely active lipolytic enzyme begins to function immediately and during the first few hours after milling, the content of free fatty acid of the oil increases about 1 per cent per hour (Browne, 1903).

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In the present studies an attempt has been made to inhibit the action of lipolytic enzyme by heating the bran at various temperatures and to explore the optimum temperature level. The second objective was to achieve maximum oil yield by testing the bran from various rice varieties and extracting it with various organic solvents.

## REVIEW OF LITERATURE

Browne (1903) reported data with reference to the chemical and physical constants of rice bran oil which had a free fatty acid (F.F.A.) content of 83.5 per cent. Tsujimota (1911) reported data on the characteristics and composition of a commercially extracted Japanese rice bran oil which contained 17.4 per cent free fatty acid.

Cruz *et al* (1932) applied ester fractionation method to determine the composition of ethyl ether extracted rice bran oil obtained from rice of the Hambas and Rantai varieties grown in the Philippine Islands. These oils had free fatty acid content of 20.5 and 21.1 per cent respectively.

The report of the oil characteristic committee of the American oil chemists society of 1937, contains the results of an analysis by Mitchel and Lauro (1937) for expressed rice bran oil imported from Japan. Refined oil obtained has been reported to have free fatty acid content 3.8 per cent.

Nedelcu and Nicolae (1972) analysed the rice bran oil and found that oil percentage was 17.4 per cent.

Nambiar (1966) reported significant features and advantages of a new and improved method of solvent extraction of vegetable oils from all kinds of oil cakes and rice bran and other oil bearing materials. Preprocessing and post-processing of cakes or bran was described. The solvent loss was about 1.5 per cent and the residual oil content of the cake tested was 1 per cent.

Garg reported (1966) that Kustun manufactured a plant of design based on a Japanese design for the extraction of oil from both rice bran and oil cakes. The maximum solvent loss was 1 per cent and the maximum oil content in the extracted meal was 1 per cent.

Chung Sing Wu (1961) obtained light yellow rice bran oil by adding 5 per cent oxalic acid to dark oil, stirring for 30 minutes, washing with water, drying and bleaching for 20 minutes at 110°C with 5 per cent clay.

Loeb and Morris (1949) investigated the various factors which contribute to the hydrolysis of the oil during storage of the bran as well as various possible methods of inhibiting.

## MATERIALS AND METHODS

Fresh rice bran samples were collected from various rice milling units. Extraction of samples was immediately started after removing the moisture content. Six replications were made for the extraction of oil from the bran of each variety. Rice bran oil was extracted by solvent extraction method using three solvents (Pet. ether 40–60 B.P, isopropanol, n-Hexane). The percentage yield of oil extracted from various varieties by different solvents was compared by Duncan's Multiple Range Test. F.F.A. and Peroxide (P.O.) Values were determined by standard A.O.C.S. method (1970).

The F.F.A. and Peroxide Values at different temperatures (40°C, 55°C, 70°C, 85°C, 100°C, 115°C, 130°C) were determined, for finding out the optimum temperature for lipase deactivity* in the bran. For the second time the experiment was run with an antioxidant lowering the values of peroxide. The data was analysed by completely randomised design.

## RESULTS AND DISCUSSION

The percentage oil yield (Table 1) of Jhona rice bran was 11.62 when Pet. ether (40-60°C) was used as solvent, while it was 13.5 per cent with n-Hexane and 14.88 per cent with isopropanol. The oil percentages for Irri-Pak bran were low as compared to Jhona rice bran, as it varied between 9.00 to 11.41 with the same solvents, i.e., Pet. ether, n-Hexane and isopropanol.

In the case of Basmati bran oil per cent yields were 10.45 with Pet. ether, 12.66 with n-Hexane and 15.68 with isopropanol respectively. The oil extracted by the isopropanol was the maximum. The percentage oil yield of Kernal Basmati with petroleum ether was 11.39, with n-Hexane 14.00 and with isopropanol 16.17 which was in conformity with the findings of Fuege R. Reddi (14 to 17 per cent) and Nedeleu (17.4 per cent). Same solvents gave oil percentages of 11.39, 14.00 and 16.17 in Kernal Basmati respectively. It is clear that the maximum oil obtained in all the brans under test, was with isopropanol and the recovery of isopropanol was 98 per cent. A statistical

*lipase activity is defined as the lipase units per kilogram.

analysis of the data (Table 1) showed that mean values for all the varieties and solvents were significantly different with one another in their performance.

Table 1. *Average percentage oil recovered from rice bran of different rice varieties using different solvents, 250 ml each.*

| | Jhona | Irri-Pak | Basmati | Kernal Basmati | Mean for Solvents |
|---|---|---|---|---|---|
| Pet. ether | 11.62 | 9.00 | 10.45 | 11.39 | 10.61 a |
| n-Hexane | 13.50 | 10.60 | 12.66 | 14.00 | 12.69 b |
| Isopropanol | 14.88 d | 11.41 f | 15.88 g | 16.17 h | 14.58 c |
| Mean values for varieties | 13.33 | 10.33 | 13.00 | 13.85 | |

Each value was the average of 6 readings. The mean values showing different letters for solvents and varieties respectively are significantly different. The means were compared by Duncan's Multiple Range Test.

Table 2. *F.F.A. and P.O. Values of crude oil extracted at room temperature from rice bran, after heating the bran for 1 hour.*

| Temp: | 40°C | 55°C | 70°C | 85°C | 100°C | 115°C | 130°C |
|---|---|---|---|---|---|---|---|
| F.F.A. Value | 10.5 | 9.60 | 9.46 | 7.7 | 5.43 | 5.9 | 6.7 |
| P.O. Value | 3.00 | 3.80 | 4.06 | 4.32 | 6.00 | 6.45 | 7.83 |
| P.O. Value with antioxidant (B.H.A. .050 grams) | 2.75 | 3.33 | 3.93 | 4.12 | 5.34 | 6.25 | 7.4 |

Experimental results in Table 2 show that F.F.A. values begin to decrease as the temperature rises. At 100°C the F.F.A. value (5.43) is minimum. This means that lipase, which initiates rapid, hydrolytic deterioration in rice bran oil, is deactivated to the maximum extent. But F.F.A. Value again starts increasing above 100°C. Temperature, above 100°C may accelerate the hydrolysis in rice bran oil as it is in agreement with the findings of Loeb and Morris (1949).

Peroxide values determined at different temperature levels for rice bran oil are minimum in the beginning at 40°C but go on increasing as the temperature rises and is maximum at 130°C i.e. 7.83.

Using antioxidant Butylated Hydroxy Anisol (B.H.A.), 0.50 grams, the peroxide values considerably decreased at 40°C to 2.75 while at 130°C, it is 7.4.

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