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Original Research Paper

Home Science

A STUDY ON CHEMICAL AND FUNCTIONAL PROPERTIES OF DEFATTED RICE BRAN

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ABSTRACT This study was carried out by determined the Chemical properties of defatted rice bran revealed that it contains 9.8±0.2% moisture content, 33.69±1.01% carbohydrate, 14.21±0.4% protein, 1.0±0.03% crude fat, 14.20±0.4% ash and 13.85±0.4% crude fibre. A slight variation in chemical composition of roasted and steamed defatted rice brans were observed compared to control. Functional properties of defatted rice bran showed good water holding capacity and oil absorption capacity in all the treatments which were ranged between 3.2±0.09g/g to 3.390.12g/g and 1.94±0.05g/ml to 2.19±0.07g/ml respectively. Foaming capacity and Emulsifying capacity of defatted rice bran were ranged between 16±0.57% to 20±0.52% and 41.53±1.24% to 45.3±11.19% respectively. The findings suggest that roasted defatted rice bran showed better chemical and functional properties compared to steamed and control defatted rice bran.

KEYWORDS : Defatted rice bran – Heat Processing – Chemical composition –Functional properties

1. Introduction

India is the world's second largest producer of rice and it is the most important cereal food crop in the country. Based on the country's paddy production, rice bran output potential is about 9.8 million tonnes. However, India is processing only 5 million tonne and the rest is consumed directly as cattle feed. Rice bran is an underutilized by products of rice milling industries. It is rich in nutrients which are moisture, carbohydrate, protein, fat, ash and crude fibre. The deactivation of lipase enzyme in rice bran is the best technique for rice bran consumption. The deactivation was done by stabilization method. It is a valuable method for rice bran utilization. The potential of rice bran for improving human health was envisaged by the researchers worldwide and reported that rice bran could be used as ingredient in food products mainly to improve the nutritional, functional and therapeutic values. The present study was aimed to study the physicochemical and functional properties of defatted rice bran.

2. Materials and methods

2.1 Purchase of raw material

Defatted rice bran was purchased from Vagai Agro Products limited, Annanagar, Madurai, Tamil Nadu, India.

2.2 Stabilization of Rice bran

Unstabilized Rice Bran (URB) (T_0) was used as the control in this study. Rice bran was stabilized in steaming method followed by Thanonkaew et al (2012) and Roasted method followed by Faria et al **(**2012). The Steamed Rice Bran (SRB) (T_1) (100g) was stabilized on a domestic cooking steamer at 130°C at 60 min. The Roasted Rice Bran (RRB) (T_2) (100 g) was heated on a conventional stove. The stabilization was performed at approximately 80ºC (high flame level) for 6 minutes, and samples were homogenized with a wooden spoon throughout the process.

2.3 Chemical properties of defatted rice bran

Chemical properties of defatted rice bran were evaluated using standard methods. Moisture, carbohydrate and ash were analyzed by following the AOAC method (2000). The soxhlet method was used for total fat estimation. Crude fiber content was determined after samples digestion with diluted acid alkali and alcohol. Moisture was estimated from sample weight loss after drying at 105°C until constant weight. Protein content was determined by lowry's method (1951). All the samples were evaluated in triplicate. Mean and standard deviation are calculated.

2.4 Functional properties of Defatted rice bran

2.4.1. Bulk density

The bulk density of different treated defatted rice bran were determined according to the method described by Bhosale and Vijayalakshmi (2015) and calculated as weight per unit volume of sample.

$$\text{Bulk density (g/ml)} = \frac{\text{gram of water bound}}{\text{volume of the sample}}$$

2.4.2. Water and oil absorption

Water absorption of defatted rice bran was determined by the centrifugation method of Hedayati et al (2014). The samples (3 g) were dispersed in 25 ml of distilled water and placed in preweighed centrifuge tubes. The dispersions were stirred occasionally, held for 30 min, followed by centrifugation for 25 min at 3000 g. The supernatant was transferred, excess moisture was removed by draining for 25 min at 50 °C, and sample was reweighed. For the estimation of fat absorption Samples (0.5 g) were mixed with 6 ml of corn oil in preweighed centrifuge tubes. The contents were stirred for 1 min with a thin glass rod to disperse the sample in the oil. After a holding period of 30 min, the tubes were centrifuged for 25 min at 3000 g. The separated oil was then removed with a pipette and the tubes were inverted for 25 min to drain the oil prior to reweighing. The water and oil absorption were expressed as grams of water or oil bound per gram of the sample on a dry basis and were calculated by the equations:

$$\text{Water absorption (g/g)} = \frac{\text{gram of water bound}}{\text{gram of the sample}}$$

$$\text{Oil absorption (g/g)} = \frac{\text{gram of oil bound}}{\text{gram of the sample}}$$

2.4.3. Foaming capacity

The capacity of foams was determined by the method of Hedayati et al. (2014). 50 ml of a 3% (w/v) dispersion of different treated defatted rice bran sample in distilled water were shacked using shaker, at high setting, for 2-3 min. The blend was immediately transferred into a graduated cylinder and the shaker cup was rinsed with 10 ml distilled water, which was then added to the graduated cylinder. The volume was recorded before and after whipping and measured as the % of volume increase due to whipping. The foaming activity was expressed as the % of volume increase. The final volume was noted in each case in a graduated cylinder.

2.4.4. Emulsifying Capacity

Emulsifying properties were determined by the method of Hedayati et al. (2014). 0.5 g sample of rice bran was suspended in 3 ml of distilled water contained in a graduated tube followed by the addition of 3 ml of oil. The contents were then shaken vigorously for 5 min. The resulting emulsion was centrifuged at 2000 x g for 30 min. The volume of the emulsified layer divided by that of the whole slurry multiplied by 100 was taken as the emulsifying activity of the rice bran sample (ml/100 ml).

2.5 Statistical analysis

Analysis of variance and significant difference among means were calculated by One way ANOVA. Data were analyzed using Data Entry Module for Agres Statistical Software (Version 3.01) developed by Tamil Nadu Agricultural University, Coimbatore. The data obtained from the various experiments were subjected to statistical analysis to find out the impact of different treatments by using Factorial Completely Randomized Design (FCRD) method as described by Cochran and Cox (1957). P values <0.05 were considered as statistically significant.

3. Results and Discussion

3.1 Chemical composition

Chemical composition of the different treated defatted rice bran were determined in this study are shown in the Table.1. The lowest moisture and fat content showed in Roasted defatted rice bran (T_2) sample. Unstabilized defatted rice bran (T_0) sample had the highest fat content and the lowest content of carbohydrate, protein, fat and crude fibre compare to T_2 sample. Steamed defatted rice bran (T_1) sample had highest moisture, carbohydrate, protein, ash and crude fibre compare to Unstabilized defatted rice bran (T_0). Different treated defatted rice bran had highly significant in moisture, protein, fat, ash and fibre (P<0.05). Thanonkaew et al. (2012) reported that the moisture content of unstabilized, steaming and roasted defatted rice bran were 14.56, 11.41 and 2.12g/100 bran. Faria et al. (2012) reported that moisture content of unstabilized defatted rice bran and roasted defatted rice bran were 8.41 and 5.14g/100, protein 16.61 and 18.93g/100g and fibre 22.67 and 20.34g/100g. The result indicate that the lowest moisture content of roasted defatted rice bran effective for samples with longer shelf life and less microbial contamination and preserve some nutrients. Steamed and roasted defatted rice bran produce in the form of good source of protein and fibre.

Table 1. Nutritional composition of Defatted rice bran subjected to two different stabilization methods

Treatment	Nutritional Composition					
	Moisture (%)	Carbohy drate (%)	Protein (%)	Fat (%)	Ash (%)	Crude fibre (%)
T_0	9.8±0.2	33.69± 1.01	14.21± 0.4	1.00± 0.03	14.2± 0.4	13.85± 0.4
T_1	12.2±0.3	33.75± 0.8	15.78± 0.4	0.44± 0.01	15.4± 0.4	14.1±0.3
T_2	5.25±0.1	34.10± 1.2	16.79± 0.6	0.34±0. 01	17.1± 0.6	19.35± 0.6
SEd	0.2238	0.8603	0.4007	0.0162	0.1021	0.4213
CD (0.05)	0.5478**	2.1052^{NS}	0.9805**	0.0397**	0.9840**	1.0308**

3.2. Functional properties

3.2.1. Bulk density

Bulk density of different stabilized defatted rice bran is noted in Table.2 and Figure 1. Among the different stabilization method the maximum bulk density recorded in Unstabilized defatted rice bran (T_0) (0.53±0.01) followed by Steamed defatted rice bran (T_1) and Roasted defatted rice bran (T_2) (0.50±0.01 g/ml). According to Hedayati et al., bulk density increases when the samples are defatted. Low bulk density of a sample is considered as an advantage when packaging or using the raw material for infant food formula.

3.2.2. Water and oil absorption capacity

The results of water and oil absorption capacity are presented in Table 2 and Figure 1. The results indicated that the water absorption capacity had higher in Roasted defatted rice bran (T_2) sample (3.39±0.12 g/g). The water absorption capacity of Unstabilized defatted rice bran (T_0) and Steamed defatted rice bran (T_1) were 3.2±0.09 and 3.14±0.08 g/g. The oil absorption capacity of Unstabilized defatted rice bran (T_0) and Steamed defatted rice bran (T_1) were 1.94±0.05 and 2.05±0.05 g/ml. Highest oil absorption capacity was noted in Roasted defatted rice bran (T_2) compare to T_0 and T_1. Water binding capacity has been widely studied in food functionality, due to its importance in foods. Water plays an important role in the major changes that occur during baking, which include starch gelatinization and protein denaturation. Hedayati et al. 2014 reported that high oil absorption capacity is important in improvement of mouth feel and flavor retention in food products.

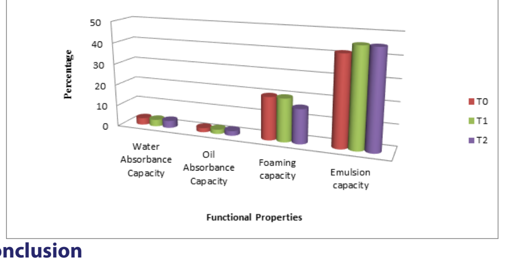
3.2.3. Foaming and Emulsion capacity

The results of foaming and emulsion capacity of defatted rice bran are presented in Table 2 and Figure1. Foaming capacity of defatted rice bran had a higher in Unstabilized defatted rice bran (T_0) and Steamed rice bran (T_1) compared to Roasted defatted rice bran (T_2) which were ranged between 16±0.57 to 20±0.6. Emulsion capacity of defatted rice bran was Unstabilized defatted rice bran (T_0) 41.53±1.24 %, Steamed defatted rice bran (T_1) 45.31± 1.19% and Roasted defatted rice bran 45.16±1.62%. Steamed defatted rice bran had a highest amount of emulsion capacity compare to unstabilized (T_1) and Roasted defatted rice bran (T_2).

Table 2. Functional properties of Defatted rice bran subjected to two different stabilization methods

Treatment	Functional properties				
	Bulk density (g/ml)	Water Absorbance Capacity (g/g)	Oil Absorbance Capacity (g/ml)	Foaming capacity (%)	Emulsion capacity (%)
T_0	0.53± 0.01	3.2±0.09	1.94±0.05	20±0.6	41.53± 1.24
T_1	0.50± 0.01	3.14±0.08	2.05±0.05	20±0.52	45.31± 1.19
T_2	0.50± 0.01	3.39±0.12	2.19±0.07	16±0.57	45.16± 1.62
SEd	0.0129	0.0831	0.0528	0.4649	1.1196
CD (0.05)	0.0317^{NS}	0.2033^{NS}	0.1293**	1.1377**	2.7396*

Fig.1. Functional properties of Defatted rice bran subjected to two different stabilization methods



4. Conclusion

From the present investigation it can be concluded that the functional properties such as bulk density, water and oil absorption, foaming and emulsifying capacity of defatted rice bran improved significantly after stabilization. Roasting process reduced the moisture content of bran more efficiently and Roasted defatted rice bran showed better chemical and functional properties compared to steamed and control defatted rice bran . The nutritional composition of rice bran preserved in both stabilization methods. High water and oil absorption capacity of defatted rice bran makes suitable for bakery products need to keep the moisture and sauces need to maintain their oil content. The results suggested that defatted rice bran can be considered as a suitable diet for human consumption and has the potential to use in new food formulations.

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Reference

1. Amonrat Thanonkaew, Surapote Wongyai, David J. McClements and Eric A. Decker.2012. Effect of stabilization of rice bran by domestic heating on mechanical extraction yield, quality, and antioxidant properties of cold-pressed rice bran oil (Oryza saltiva L.). Food Science and Technology. 48: 231-236.
2. AOAC, Official methods of analysis. Association of official analytical chemists 17th Ed., Gaithersburg, Maryland, USA 2000.
3. Cochran, W. G. and Cox, G. M. 1957. Experimental Designs. 2nd ed. Wiley, New York.
4. Keshavarz Hedayati, A., M. Alami, A. Motamed Zadegan, Y. Maghsoudlou, M. Ghorbani, A. Daraei Garmakhany and S. Hassan Mossavi. 2014. Functional and physicochemical properties of Iranian rice bran. Minerva Biotec 26:31-40.
5. Lowry OH, Rosebrough NJ, Farr AC and Randal RJ. 1951. Protein analysis with folin-phenol reagent. Journal of Biological Chemistry 193:265-75.
6. Shweta Bhosale and Vijayalakshmi,D. 2015. Processing And Nutritional Composition of Rice Bran. Current Research in Nutrition and Food Science Vol. 3(1):74-80.
7. Simone Aparecida dos Santos Conceicao Faria, Priscila Zaczuk Bassinello, Marilene de Vuono Camargo Penteado. 2012. Nutritional composition of rice bran submitted to different stabilization procedures. Brazilian Journal of Pharmaceutical Sciences. 48 (4): 651-657.