

A NOTE ON PROTEIN CONCENTRATE FROM FULL-FAT RICE BRAN¹

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In the U.S. very little rice bran is defatted. Hence, the data on protein recovery from defatted bran previously reported from this (1) and other laboratories (2,3) are not generally applicable in this country. However, the approximately 50,000 tons of protein present in bran from the annual U.S. production comprises a valuable potential source of food protein. Accordingly, extraction of full-fat bran was undertaken to learn of its potential and the relation of the resulting product to that obtained by a similar process from defatted bran. The recovery of bran protein could well increase the value of the bran and provide greater aid in bearing the costs of rice milling. Results obtained are reported briefly herein.

MATERIALS AND METHODS

California Pearl (Caloro or Colusa variety) bran direct from the milling line was used without further treatment and stored at -10°C or below until used. The bran (dry basis) contained 11.5% crude protein, Kjeldahl $\text{N} \times 5.95$, 12.8% fat, 9.6% ash, and 11.5% crude fiber. California Pearl bran was also used in our earlier studies on extraction and recovery of protein from defatted bran (1), but for the presently reported work, a different fresh lot of bran was used.

Procedures were those of Chen and Houston (1), except for an increase in extraction time from 1 to 2 hr. The extraction process consisted of stirring the bran with aqueous NaOH at selected pH values at room temperature ($23^{\circ}-25^{\circ}\text{C}$) with a 7.5 v/w solvent:bran ratio, centrifuging, and then extracting residual solids with water in half the volume of alkali first used. Protein concentrates were formed by acidifying the combined extracts to pH 4.5 (pH of maximum protein precipitation in the case of full-fat bran) with HCl, centrifuging out solids, and lyophilizing them. A modification comprised stirring the moist protein concentrates with 80% ethanol for 2 hr, centrifuging, and lyophilizing. Fat, ash, and crude fiber were determined by AOAC methods (4). All values reported are results of at least duplicate determinations or processes.

RESULTS AND DISCUSSION

At pH values 8, 10, 11, and 12, the per cent of total bran protein solubilized was 43, 57, 67, and 70, respectively; per cent total solids solubilized was 14, 17, 19, and 32, respectively. At pH 11 (optimal), recovered extract plus water wash contained 58% of the total bran protein of which 76% precipitated at pH 4.5. The gray-brown acid precipitate contained 44.1% of the total bran protein; its protein concentration (dry basis) was 62%. The alcohol wash changed the color to a creamy tan and raised the protein concentration (dry basis) to 76%. The alcohol

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²Retired.

TABLE I
Composition of Solids and Yield of Protein from Rice Bran Extracts^a

Component	Full-Fat Bran 2-hr Extraction		Defatted Bran 1-hr Extraction ^b	
	In ppt ^c	In supernatant	In ppt	In supernatant
Composition, % dry basis				
Protein	76.1	14.3	85.0	17.0
Fat	14.1	1.8	1.3	0.3
Ash	3.5	3.2	4.2	21.7
Carbohydrate (by diff.)	6.3	80.7	9.5	61.0
Yield of protein (% of total bran protein)	44.1	13.9	36.8	11.9

^aNaOH extraction, pH 11, 7.5 v/w solvent:bran ratio, 25°C.

^bFrom ref. (1).

^cAlcohol washed.

wash removed essentially no protein. The composition of the alcohol-washed acid precipitate is compared in Table I to that of the concentrate recovered from defatted bran (1) by a similar process but without the alcohol wash. On a fat-free basis, the protein concentrations of the precipitates are very similar. The high ash content in the residue supernatant from defatted bran (Table I) as compared to the low ash content in the residue supernatant from full-fat bran is unexplained. However, it indicates that most of the ash of the full-fat bran is not extracted but remains associated with the insolubles.

CONCLUSIONS

Protein solubilization was slightly greater at pH values 8 and 10 in full-fat bran than in defatted bran but less at pH values 11 and 12. At the optimal working pH of 11, the percentage of total bran protein extracted and recovered by acid precipitation was slightly higher for the full-fat bran (44 vs. 37%) but with somewhat lower protein concentration (62 vs. 85% or 76 vs. 85% when the full-fat precipitate was washed with alcohol). The relatively high-fat content of the concentrate from full-fat bran could cause a potential instability of the product but might be reduced through additional treatments with a concurrent increase in protein concentration.

In general, it has been shown that a 76% protein concentrate can be prepared by relatively simple processes from full-fat bran. Such a procedure could make available considerable amounts of good quality food protein in rice-growing regions where defatting of rice bran is not usually practiced.

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