Note on a Simple Method to Produce a High Extraction Faba Bean Cotyledon Flour[1]

M. M. MORAD[2] and P. L. FINNEY[3]

Cereal Chem. 57(3):230

Because of the physicochemical properties of dried faba beans (*Vicia faba*), milling and separation of the seed coat fraction has generally required rather elaborate milling and sifting operations. Watson et al (1975) milled faba beans of the variety Ackerperle grown at the University of Manitoba and obtained a 75.9% yield. They prebroke the bean twice with an Allis Chalmers system and then milled the entire stream with a Buhler MLU202 experimental mill. Watson et al developed their method after unsuccessful attempts to "produce a satisfactory flour in substantial yields by first dehulling the bean by several different dehullers followed by reduction with a variety of mills including hammer, pin, and roller." D'Appolonia (1977) modified Watson's method by first removing some of the seed coat after the prebreak with a U.S. 710-μ (No. 25) Tyler sieve. Sifting after the prebreak probably improved cotyledon flour purity; D'Appolonia did not publish chemical analysis or extraction rates, however, but used the bean flour in bread-baking studies.

In this note, we present a simple laboratory milling procedure using the Hobart "coffee" grinder and a sieving procedure that gives an 88% extraction cotyledon flour with 2–4% hull, depending on sifting operations.

MATERIALS AND METHODS

Faba Bean Samples

Preliminary milling studies were made on three bean samples imported from the Middle East. The data reported here were obtained from a composite of equal amounts of three varieties, similar in shape, color, and size (Diana, Ackerperle, and Hertz Freya), which were grown on experimental plots at the University of Manitoba in 1978. The beans were hand-cleaned of damaged or apparently unsound seeds.

Analytical Procedures

Moisture and nitrogen content were determined according to AACC procedures (1962). The nitrogen value was multiplied by 6.25 to obtain the protein content.

Milling Procedures

Mechanical Milling. The faba beans were ground in a Hobart grinder four times before sifting operations began at the following settings: open two full turns (20 units), open one full turn (10 units), open one-half turn (5 units), and open 3 units. The flour was then hand-sifted on a U.S. Standard Tyler 710-μ sieve (No. 25) with a 15-in. diameter. Overs were designated seed coat. Throughs were again Hobart-ground (open 2 units) and then sifted on a U.S. Standard Tyler 710-μ sieve (No. 25) with an 8-in. diameter. Overs were included in the seed coat fraction and throughs were again ground at a setting that was open 1.5 units. Flour was sifted on a U.S. Standard Tyler 417-μ sieve (No. 40) with an 8-in. diameter. Overs were included in the seed coat fraction, throughs in the flour fraction.

Hand-peeling. A subsample of the Canadian composite was steeped for 40 hr, and the seed coats were removed by hand. Both seed coat and cotyledon fractions were oven-dried (130°F, 8 hr) and then Hobart-milled to a flour for analysis and extraction calculations.

TABLE I
Protein Content and Extraction Rate of Faba Bean (*Vicia faba*) Flour

Stream	Percent Protein, db (N × 6.25)	Percent Whole Bean
Whole faba bean	31.2	100.0
Mechanical milling		
Cotyledon flour	33.9	88.0
Seed coat	12.0	12.0
Hand peeling		
Cotyledon flour	35.1	87.0
Seed coat	4.4	13.0

RESULTS AND DISCUSSION

By comparison of the protein contents of hand-separated and Hobart-milled faba bean fractions, accurate extraction rates and purities of fractions may be estimated (Table I). Algebraic computation based on the data (Table I) indicated that approximately 4.0% of the mechanically milled cotyledon fraction was seed coat, whereas 24.9% of the seed coat fraction was cotyledon. Thus, when mechanically milled and sifted as we have described, 100 g of faba beans yielded 88.0 g of a cotyledon endosperm fraction that contained 84.5 g of cotyledon and 3.5 g of seed coat and 12 g of a seed coat fraction that contained approximately 9.0 g of seed coat and 3.0 g of cotyledon.

Efforts to purify either mechanically milled fraction by more reduction or sifting steps were unsuccessful. At the expense of yield, however, a cotyledon flour fraction with about 50% less hull is obtainable by reducing sieve sizes for all operations.

LITERATURE CITED

AMERICAN ASSOCIATION OF CEREAL CHEMISTS. 1962. Approved Methods of the AACC. Method 46-10, approved April 1961. The Society: St. Paul, MN.

D'APPOLONIA, B. L. 1977. Rheological and baking studies of legume-wheat flour blends. Cereal Chem. 54:53.

WATSON, J. W., McEWEN, T. J., and BUSHUK, W. 1975. Note on dry milling of faba beans. Cereal Chem. 52:272.

[1]Scientific Paper 5424, College of Agriculture Research Center, Washington State University.

[2]Associate professor, Department of Food Science, Cairo University, Cairo, Egypt.
[3]Research food technologist, Western Wheat Quality Laboratory, Science and Education Administration, U.S. Department of Agriculture, Pullman, WA.

Mention of a trademark or proprietary product does not constitute a guarantee or warranty of the product by the USDA and does not imply its approval to the exclusion of other products that may also be suitable.

[Received August 10, 1979. Accepted January 27, 1980]