Experimental Coconut Protein Products

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INTRODUCTION

All coconut protein food products are still in the research stage. They have not proven their worth in the marketplace; they have not been scrutinized by regulatory agencies; their product specifications have not been written; and their potential food uses have not been adequately explored.

What has been accomplished is that enough processing technology has been developed so that small quantities of coconut protein products were produced and evaluated; and some rough estimates of economic feasibility have been made.

The work so far accomplished has not uncovered any reason why coconut protein cannot be used as a food, such as low nutritional value, poor taste, or high costs. That coconut protein is not yet produced commercially is probably due to inadequate marketing research and the unrefined state of the technology.

PRODUCT COMPOSITION

In preparing a food protein product, we must adjust our procedure to the characteristics of the raw material. The composition of final product is largely determined by how the processing copes with the raw material characteristics. A few words about the raw material will help us to organize our thoughts about product composition.

A very important characteristic of our raw material, coconut meat, is its high crude fiber content. This has led to the development of two kinds of coconut product, namely, those high in crude fiber and those low in crude fiber.

Coconut Flour

The high fiber coconut protein product is generally called "coconut flour," and this consists of nothing more or less than what remains of coconut meat after it has been dried and the oil extracted. This is the same nomenclature as used for soybean flour, peanut flour, etc.

Coconut Flour can be white or brownish, depending on whether or not the brown outer layer of the meat is removed in processing. For the sake of appearances, the white flour is recommended.

Coconut flour can be high fat or low fat, depending on how much oil is removed in processing. The low fat flour has blander taste and is more stable, but it is more expensive to produce.

Typical composition of white coconut flour is given below. The composition of brown coconut flour is similar except that it contains roughly 2% more crude fiber and 1.5% less protein (1-5).

Typical Composition of White Coconut Flour

	Low fat	High fat
Moisture, %	5	5
Oil, %	0.5	15
Protein (N x 6.25, %)	24	20
Crude Fiber, %	10	8
Ash %	5	4

Low Fiber Products

These products have higher protein content than coconut flour. They are analogous to the soybean protein concentrates. Because none of the high protein products are standardized, there seems to be no point in cataloging their compositions. Instead, the discussion will be limited to one prepared in our own work, not because it is ideal, but rather because it is somewhat typical.

This particular product, and all other low fiber coconut protein products as well, are prepared from the coconut milk extracted out of fresh coconuts. For our product the oil is first skimmed from the milk by centrifugation; the resulting low fat coconut milk is spray dried to produce a product we call Cocopro. This is a white powder (1) with 32% protein, 4% moisture, 0.2% crude fiber, 9% ash, and 8% oil.

We have recently redesigned our process to make a product with higher protein content; however, at this time the work is incomplete.

PRODUCT EVALUATION

Coconut Flour

Quite a lot of work has been done with coconut flour, chiefly as an ingredient in baked goods. It has been successfully incorporated into bread at the 5-20% level (6-9).

Coconut flour has good nutritional value. White coconut flour has (corrected) PER of 2.8, biological value of 64%, net protein utilization of 52%, and 81% true digestibility (2).

Coconut Flour is not known to have undesirable components such as some other oilseed flours. I know of no problems encountered with flatus factors, enzyme inhibitors, aflatoxin, or taste.

Low Fiber Coconut Products

The low fiber protein products are analogous to the concentrates made from soybean meal, although generally of lower protein content.

The low fiber protein products have been shown to have good nutritional value (10). In some work with human infants, they had higher nutritional value than cottonseed flour, INCAP NO. 8, peanut flour, sunflower seed flour, or sesame flour (11).

As for our product already mentioned (Cocopro), it has (corrected) PER of 1.8. It can be reconstituted with water to give a milky liquid which has found limited acceptance as a beverage. It can serve as a replacement for milk in baked goods. The product has a sweet, coconut flavor. It is somewhat salty (potassium salts) and readily absorbs moisture from the air (1). These properties have led us to try to develop a product with higher protein content and less ash.

SUPPLIERS OF COCONUT PROTEIN PRODUCTS

As already mentioned, there are no regular, commercial suppliers. The list presented below consists of those people who have been known to supply samples within the past

several years. The inclusion of their names here does not imply that they are advertising or are even willing to provide samples. It would be the task of the recipient to persuade them to supply the merchandise.

SOURCES OF COCONUT FLOUR

1. Franklin Baker Co. of the Philippines
   ITC Building
   Buendia Avenue Extension
   Makati, Metro Manila
2. Blue Bar Coconut Philippines, Inc.
   JMT Building
   6764 Ayala Avenue
   Makati, Metro Manila
   Att'n Dr. Bienvenido Sison
3. Philippine Coconut Authority
   Food Research Division
   Don Mariano Marcos Avenue
   Diliman, Quezon City
   Att'n Miss Portia Marquez

LOW FIBER COCONUT PROTEIN PRODUCTS

1. Coconut Foods Pilot Plant
   University of San Carlos
   Talamban, Cebu City
2. National Institute of Science & Technology
   Taft Avenue
   Metro Manila
   Att'n Mrs. Olympia Gonzales

Future Suppliers

Here we can only speculate on the prospects. It would seem that the Philippines would be the most likely source, given their dominant position with 45% of world production, and also the fact that only about 2% of their coconut production is consumed as unprocessed nuts.

Coconut protein is a by-product of coconut oil production, with about 110 kg of protein corresponding to one metric ton of oil. This is only about 6% of the same factor for soybean, which contains about 1.9 tons of protein per ton of oil.

World production of coconut oil is only about 30% of soybean oil production. Taken together with the above cited figures, we calculate that potential coconut protein food supplies are only about 2% of potential soybean protein food supplies.

REFERENCES

1. Hagenmaier, R.D., "Coconut Aqueous Processing," San Carlos Publications, University of San Carlos, Cebu, 1977.
2. Miranda, C.L., L.M. Dumada-ug, M.H. Santos, J.M. Gonzales, Phillipp. J. Nutr. 21:59 (1968).
3. Samson, A.S., R.N. Khaund, C.M. Cater, and K.F. Mattil, J. Food Sci. 36:725 (1971).
4. Hagenmaier, R.D., M. Glissendorf, and K.F. Mattil, Coconuts: Philipp. J. Coconut Studies 1:37 (1976).
5. Hagenmaier, R.D., P. Quinitio, S.P. Clark, JAOCS 52:439 (1975).
6. Chastain, M.F., S.J. Sheen, and T.J. Cooper, J Food Sci. 40:1014 (1975).
7. Khan, M.H., R.D. Hagenmaier, L.W. Rooney, and K.F. Mattil, Baker's Digest, 50(4) (1976).
8. Engel, R.W., PAG Bulletin 4:29 (1973).
9. de Leon, S., "Food Uses of Coconut," Presented at the Coconut Industrial Research Workshop, Development Academy of the Philippines, Tagaytay City, Februrary 28-29, 1976.
10. Rao, G.R., G. Ramanatham, K. Indira, U.S. Bhima Rao, M.R. Chandrasekhara, K.J. Carpenter, and D.S. Bhatia, Indian J. Exp. Biol. 5:114 (1967).
11. Snyderman, S.E., A. Boyer, and L.M. Holt, Jr., "Evaluation of Protein Foods In Premature Infants," Natl. Acad. Sci., Washington, DC, 1961.

Potato Protein for Human Food Use

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ABSTRACT

Potato protein can be produced as by-product of potato starch production in relatively large amounts. The technical problems concerning the production as well as the necessary purification of the protein for human consumption are mainly solved. However, the marketing of potato protein is difficult because it can be used, without purification, only in limited fields. Besides many physiological advantages, there may exist som hygienic risk factors which must be investigated in detail before potato protein can be applied by the food industry as a new source of protein.

World production of potato starch amounts to about 2 million tons (1), thereby the resulting potato fruit water contains about 2% protein besides other soluble substances. Half of the protein can be coagulated by direct steam injection into the fruit juice. The coagulate can be recovered by subsequent centrifugal separation and drying (2).

This means that about 100,000 tons of potato protein could be produced if all potato starch producers would install a protein recovery system.

But there are some reasons why potato protein is not recovered. One reason is the relatively low protein concentration in the fruit water. The second reason is that this concentration is further diluted during starch extraction because of additional amount of water which is usually necessary for isolating the potato starch. This diluted fruit water is then either used for irrigation or discarded as waste water.

Due to severe pollution control regulations concerning the waste water quality and highly improved starch extraction processes which enable undiluted separation of the fruit water, the installation of a protein recovery system becomes more and more attractive.

But besides lower water pollution and the costs of the protein production, there are some properties of potato protein which are of great importance for its potential uses. These properties will be briefly outlined here.

Directly precipitated potato protein from potato fruit water is obtained with a purity of 80-85% without additional purification steps. The most important physical properties of potato protein are its insolubility and color. According to the precipitation conditions, the color varies from pale yellow to greyish-green or brown.

As far as the amino acid composition is concerned, the quality of potato protein is fairly good, considering that it is a vegetable protein. The biological value is about 80, compared to that of egg protein as 100 (3,4). Most important is its relatively high lysine content. This is why potato protein can be used in protein mixtures for raising the nutritional value. In contrast, it has a low methionine con-