CIATECH: A Summary of Its Work Using Soya to Produce Nutritional Food at Low Cost

A.C. GRIENSEN, Centro de Investigaciones y Asistencia Tecnológica del Estado de Chihuahua, A.C., Apartado Postal 1067, Chihuahua, Chih., Mexico

INTRODUCTION

Four years ago we started working in soya processing technology. We considered, among other things, that Chihuahua is fourth in soybean production in the country (1). However, the bulk of the soya crop had been dedicated to oil production and animal feeding. We decided to do an intensive preliminary research on the possibilities of soya processing as human food. The product that attracted our attention most was full-fat soya flour (FFSF). It is high in protein and calories and has a relatively low cost.

Once the preliminary search for information was completed, Ciatech's staff started to work on a project for the installation of a plant that would produce FFSF suitable for human consumption. This started our work in this field. We have progressed since that time, and I want to briefly show the results of our efforts from 1977 to the present (2).

PADSA (PRODUCTOS ALIMENTICIOS DELICIAS. S.A.) FULL-FAT SOY FLOUR PLANT

Our initial research indicated that the most adequate method for the preparation of FFSF was the extrusion process, which is simple, has low initial investment and produces a good quality product high in protein and fat.

Ciatech provided market survey coordination, basic engineering and detailed engineering development, and technical advice for the purchase and installation of the machinery. Private funds for the project were obtained from an agricultural cooperative in Delicias, Chihuahua. This FFSF plant is in the heartland of soybean production in the state of Chihuahua; it was inaugurated by the President of Mexico, José López Portillo, in March 1978. The plant cost $262,312 (U.S. dollars), produces 4 tons of FFSF per 8 hr, and employs 12 people. Prices at the plant are $.63/kg bulk, $.78/kg wholesale, and $1.00/kg retail.

The processing scheme is shown in Table I (3); the proximate analysis was 39.1% protein, 26.8% fat, 4.4% moisture, 5.2% ash and 3.6% fiber.

USES OF FFSF IN MEXICO

FFSF is used at the industrial level as a partial substitute for eggs in bakeries and cookie factories, and as a meat substitute in meat processing plants. At the commercial level, FFSF is used to increase the nutritional value of food such as beans; rice, cereals, wheat and corn flours at a domestic level; we designed a book of recipes using FFSF to hand out to housewives.

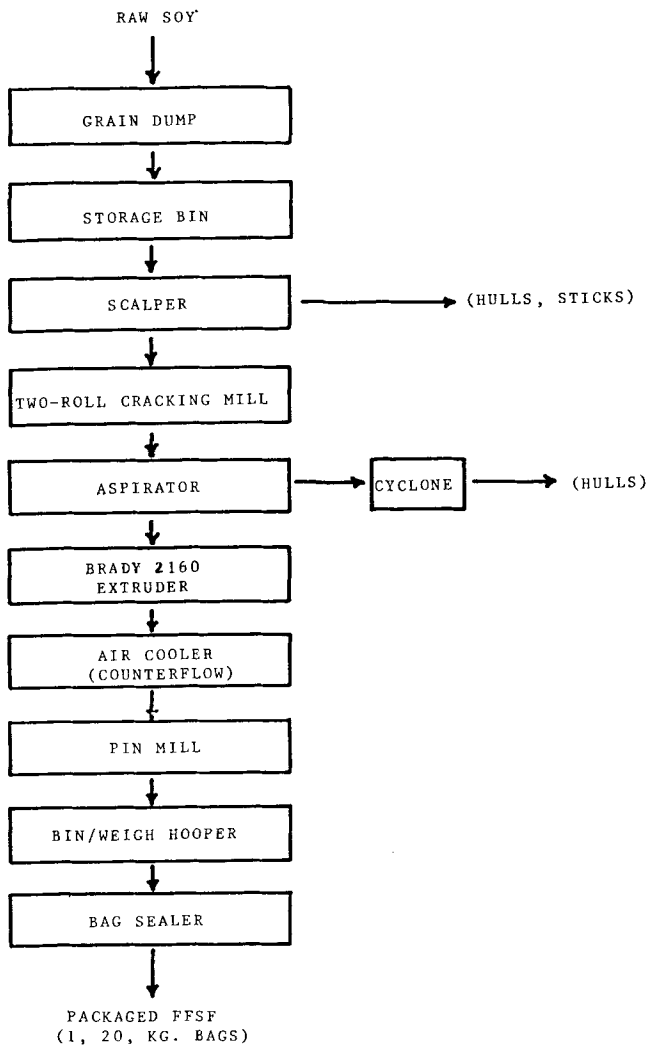
On June 26, 1980, a contract was signed between PADSA and CONASUPO (Compañía Nacional de Subsistencias Populares, an organization of the federal government in charge of purchasing and distributing basic food). The terms of the contract (4) are as follows: (a) to produce corn flour enriched with 8% FFSF for tortillas. These products are to be distributed in the states of Chihuahua, Nuevo León, San Luis Potosí, Durango and Coahuila through the DICONSA'S stores. (b) Initially, PADSA will produce 250 tons per month starting in June of this year. Eventually the production will be increased to 500 tons per month. (c) Ciatech will provide technical assistance in order to guarantee the nutritional improvement of the product supplemented with FFSF.

ALBACHISA

The Albachisa plant started in November 1979 to produce a soya based drink made from FFSF, sugar, coconut oil, flavor (vanilla, chocolate, strawberry) and color. The in-

TABLE I

Processing Line of Full-Fat Soy Flour at Padsa



gredients are cooked (batch pasteurization), homogenized, cooled and packed, as shown in Table II. The beverage has the same protein and fat values as milk, with 2.8% protein and 3.0% fat, and is helping to fill the deficit for milk in the area. The plant, which cost $173,913 (U.S.), produces 5,000 ℓ/8 hr of the drinks and has 10 employees. The product sells for $.41/ℓ wholesale and $.46/ℓ retail.

DEVELOPMENT OF MILK EXTENDER

We are working on elaboration of a milk extender, utilizing powdered milk and FFSF, that gives a liquid product with 20% milk extender. This economic milk has the same nutritional and organoleptic characteristics as normal milk, and will cost $0.07 (U.S.) less per ℓ. Since August, Albachisa will produce initially 1,500 ℓ/day for DIF-Chihuahua (Family Integral Development Agency).

COOKING EXTRUDER

The heart of the low cost technology for soya processing is the extruder. Therefore, in November 1978, we indicated to President Portillo the importance of making this type of machinery in Mexico. Later in March 1979, we presented to him the first extruder made in Chihuahua by Mexican technicians. At the same time we showed what we considered to be the most important application of this machinery, that is, its use in the production of enriched corn flour using 8% soybeans. This product is to be used to make tortillas.

Almesa (Alimentos Mejorados. S.A.)

The Almesa plant started up officially on December 8, 1979, immediately after its inauguration by the President of Mexico. One of the reasons for setting up the plant in this area was the advice given to us by Rosa Luz Alegría to locate the industry close to the rural areas in which the Tarahumaras (the natives) live.

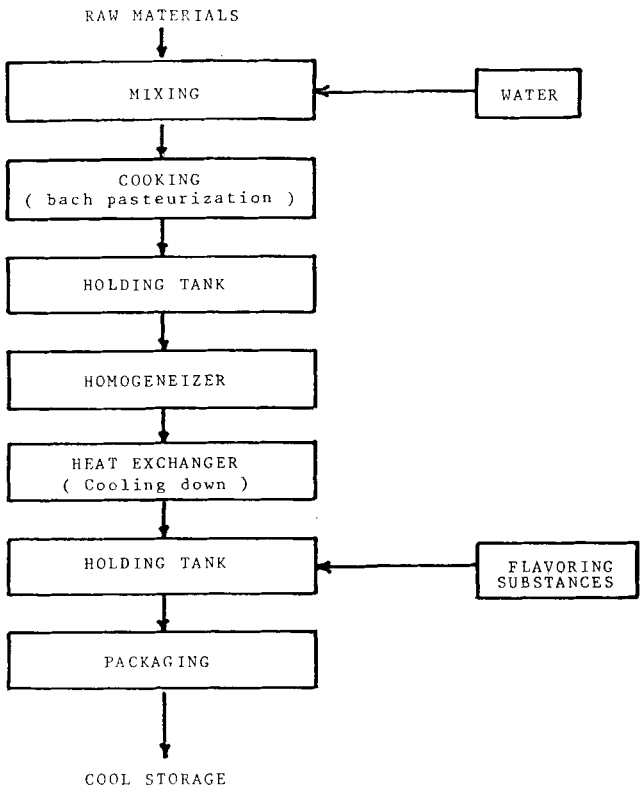
It is important to mention that all the machinery was made in Chihuahua. The entire project took only 6 months, cost $260,870 (U.S.), has a capacity of 2,900 tons/yr and employs 7 people. Retail prices at the plant are $.23/kg for sunuko (corn flour enriched with soya); $.60/kg for pinole con proteínas (ground and toasted corn enriched with soy); and $.84/kg for avena con proteínas (precooked, ground oatmeal with soy). The composition of these products is shown in Table III.

Agreement between Ciatech, Coplamar and INI

Through an agreement reached on November 28, 1979, between Ciatech, Coplamar (federal office for the attention of marginal groups), and INI (native affairs agency), Almesa will provide 30 tons/month of enriched corn flour and 5 tons/month of enriched pinole over a one year period starting in January 1980. At the same time, enriched oatmeal would be gradually introduced to the native diets. These products would be fed mainly to the native children in the room and board schools of the Sierra Tarahumara. Ciatech, in its role as state government representative, would control the production and quality of the products.

TABLE II

Processing Line of Albachisa, Soy-Based Drink



TECHNICAL ASSISTANCE TO COSTA RICA

Taking into account our experience in FFSF processing, CARE-Costa Rica, CITA (Centro de Investigación en Tecnología de Alimentos; Food Technology Research

TABLE III

Proximate Analysis of Almesa's Products As Compared to Lime Treatment Corn (Nixtamalización)

Product	Moisture (%)	Protein (%)	Fat (%)	Raw fiber (%)	Ash (%)	Carbohydrates (%)
Enriched corn flour	8.78	12.31	5.53	2.66	1.42	78.08
Enriched oat meals	6.7	17.34	11.33	2.86	1.74	60.03
Enriched pinole	6.38	11.91	5.19	2.6	2.07	71.83
Lime treatment corn (nixtamalizado)	10	7.5	4.5	1.19	1.0	74.8

Center), and the Health Ministry of Costa Rica came to Ciatech to receive technical advice in the development of their nutrition programs. Our collaboration agreement dated December 15, 1979, was to help in the formulation of foods partially supplemented with FFSF. Because of this, there were substantial savings in the cost of the products. The work began in February 1980 and ended in May of the same year.

DESIGN AND CONSTRUCTION OF EXTRUDERS

Based on the results obtained with the first extruder (75 HP) installed in Almesa, we decided to design a larger extruder (200 HP) to increase production capacity and reduce operation cost. The approximate capacity of this new extruder will be 1,000 kg/hr. We are also working on the design of some 30 HP extruders because it would be more appropriate for small communities to install smaller plants.

We think that, as much as is possible, we are contributing to the national and international efforts to overcome malnutrition. We are considering the possibility of installing plants in the future similar to the ones we have described in this paper, especially in those areas in which malnutrition is most severe. We are most willing to exchange experiences with anyone and to listen to your advice and suggestions.

ACKNOWLEDGMENTS

The author acknowledges CONACYT, the Chihuahua state government and LANFI. Proximate analyses were done in Ciatech Laboratory, and technical assistance was provided by Ciatech's staff.

REFERENCES

1. Agricultura 78, Departamento de Economiá, Gobierno del Estado de Chihuahua.
2. "Full Fat Soy Flour Plant, Chihuahua, Mexico," Evaluation of Low-Cost Extrusion Cookers for Use in LDC's (Annual report), Colorado State University, Fort Collins, CO, July 1978.
3. Harper, J., Food Engineering International, 4:22 (1979).
4. Contrato PADSA-CONASUPO, Oficio No. DG-1721/80, Compañía Nacional de Subsistencias Populares, Ave. Juárez No. 92, México 1, D.F., June 1980.