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4.3 EXTRUSION COOKING: A PROCESS TO UTILIZE WHOLE BEANS WITH THE HARD-TO-COOK DEFECT.

L. ELIAS, L.F. DE LEON and R. BRESSANI

DIVISION OF AGRICULTURAL AND FOOD SCIENCES
INSTITUTE OF NUTRITION OF CENTRAL AMERICA AND PANAMA (INCAP)
P.O. Box 1188, GUATEMALA

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EXTRUSION-COOKING: A PROCESS TO UTILIZE WHOLE BEANS WITH THE HARD-TO-COOK DEFECT

A summary of previous results obtained with this alternative for the use of hardened beans are described below.

a) The best processing conditions found for the extrusion cooking process, as far as the functional and nutritional properties is concerned, are as following: moisture content 19%; particle size 20 mesh; feeding auger speed 16 rpm; cone opening 0.8 mm; average feeding rate 500 kg/hr.

b) Protein Efficiency Ratio (PER) and protein digestibility were higher and trypsin inhibitor activity were lower for the extruded beans as compared with beans cooked in the autoclave.

c) Water absorption index and water solubility index were also higher for the beans processed by the extrusion-cooking method. A summary of these findings is shown in Table 3.

Processing Technology and Utilization of Extruded beans

Hard-to-cook beans processed by the extrusion-cooking technology may be used in a wide range of food products, and as such, the process can be transferred to local food industries. Because the extruded bean flour showed improved nutritional and technological characteristics, it can be used in a variety of products based on beans which are consumed in Guatemala as well as in other Central American countries, or blend with other foods to improve functional properties and nutritional quality.

This last approach is now underway., by complementing common bean with soybean protein using two processing technology: extrusion-cooking and "drum-drying". In both cases the following common bean-soybean mixtures were studied: 82/20, 70/30 and 60/40. For the extrusion-cooking technology, a flow diagram and processing conditions are shown in Figure 1. Extrusion conditions were as follows: feeding auger speed 16 rpm; moisture content 18%; particle size 20 mesh; outlet temperature 140, 150 and 160°C cone opening variable and was controlled by the selected temperature. Figure 2 shows the flow diagram and processing conditions used with the drum-drying process. Conditions used were: drum velocity 3, 5 and 7 rpm; drum temperatures 120°C (40 psi), 130°C (60 psi) and 140°C (80 psi). The final products of each one of the processed used (extrusion and drum-drying) under different processing conditions will be analyzed by their chemical, nutritional and functional properties, in order to select those with the best possibility to be transferred to local food industry. At present, all the samples which includes the two processes with each one of the conditions previously described has been prepared; chemical nutritional, functional and sensory evaluation are now underway.

TABLE 1

FUNCTIONAL AND NUTRITIONAL PROPERTIES OF HARDENED BEANS PROCESSED BY EXTRUSION-COOKING, AS COMPARED WITH BEANS COOKED IN THE AUTOCLAVE

Physical or nutritional properties	HARD-TO-COOK BEANS	
	Cooked in the autoclave*	Extrusion cooking**
Trypsin inhibitors (UTI/ml)	5.00	2.16
Water absorption index	2.94	3.79
Water solubility index	10.61	19.11
Available lysine (g/16 g N)	8.87	5.87
Protein efficiency ratio (PER)	0.95	1.44
True digestibility	67.9	80.5

* Beans cooked in the autoclave at 121°C and 15 psi for 25 minutes.

** Moisture content 19%; particle size 20 mesh; feeding auger spped 26 rpm; - cone opening 0.8 mm; average feeding rate 500 kg/hr.

FIGURE 1

FLOW DIAGRAM FOR THE PREPARATION OF A PRECOOKED FLOUR MADE OF HARDENED BEANS AND SOYBEAN

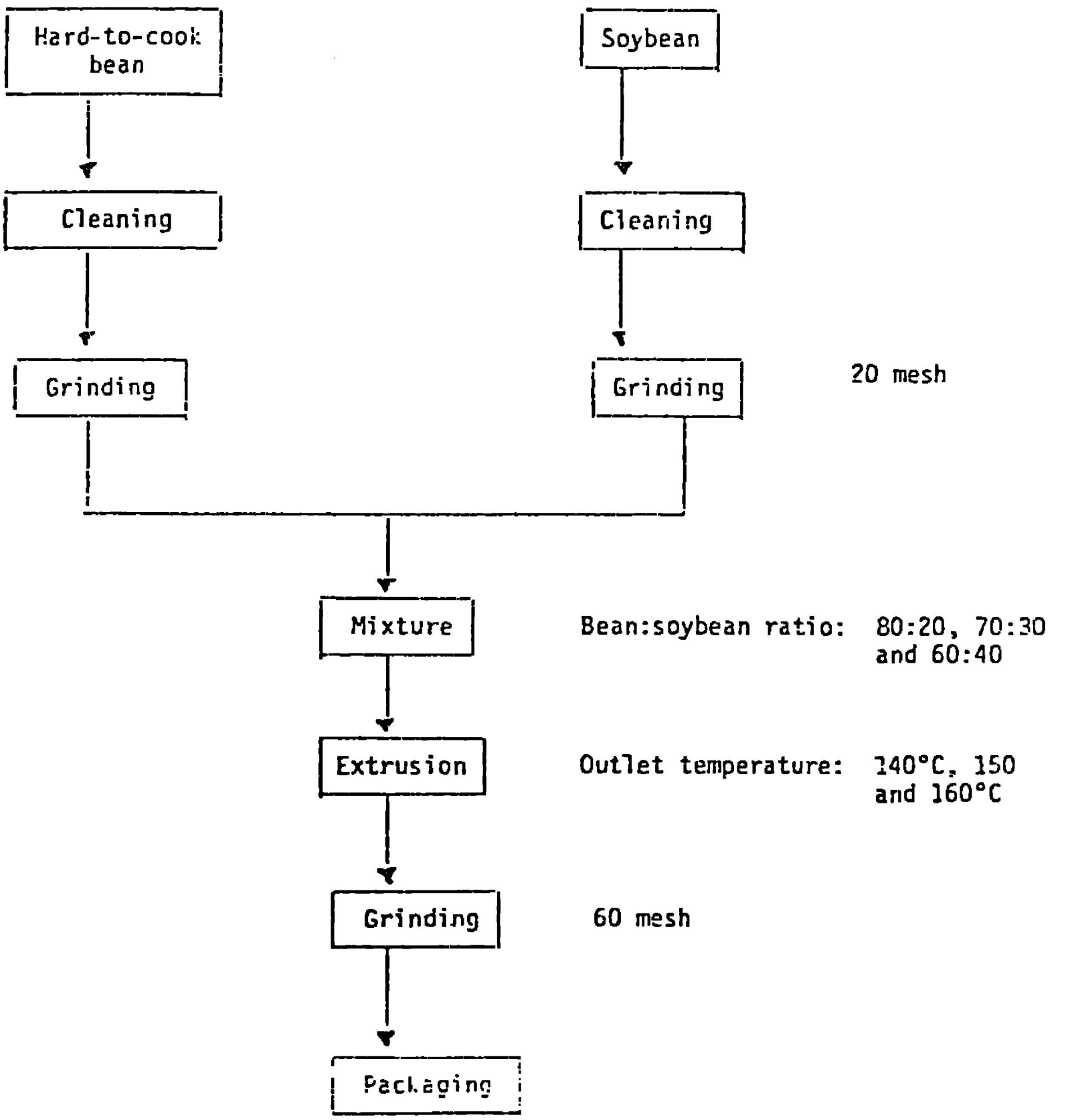

FIGURE 2

FLOW DIAGRAM FOR THE PREPARATION OF A PRECOOKED FLOUR MADE OF HARDENED BEANS AND SOYBEAN