

SOYBEAN PROCESSING FOR FOOD USE IN TAIWAN

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Abstract

Processing methods and eating habit of some of the Chinese soybean foods are described in this paper. The soybean foods so depicted include soy milk, instant soy milk powder, tofu, soybean pudding, hard beancurd, beancurd thread, spiced and dried hard beancurd, protein-lipid film and its products, sufu, chou tofu and dehulled soybean powder.

Taiwan, imported 1,150,433 tons of soybeans from the United States in 1982. In the same year, the domestic production of soybeans reached 11,942 tons. Eighty percent of soybeans are used to be processed into soybean oil. Defatted soybeans are mixed with imported corn or fish flour for feed. Defatted soybeans are also the major raw material for the manufacture of soy sauce. The other twenty percent of soybeans are processed to versatile soybean foods. They are directly consumed by our people every day. The processing technologies of these foods evolved more than two thousand years ago. In this report, the methods used currently are described.

Soy milk

In the morning, there are many shops selling sweetened or salted soy milk. The soy milk so sold is produced by the shops themselves by a traditional method consisting of soaking the beans, grinding them in water, filtering to remove the sediment and then heating the extract (Fig. 1). Soy

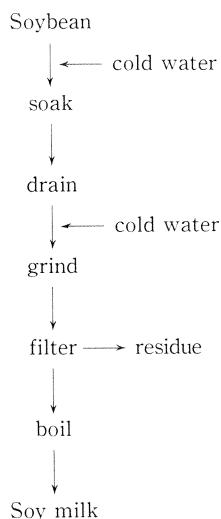


Fig. 1 Flow sheet of soy milk production by traditional method.

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milk is heated to keep hot when it is being sold. In summer, cold soy milk is also sold. Sweetened soy milk is prepared by the addition of sugar only. Salted soy milk is prepared by the addition of soy sauce, vinegar, crumbs of deep fried dough, dehydrated radish, fresh scallion and sesame oil just before eating. In the food stores or supermarkets, soy milk packaged in glass bottles or tetra pack is being sold. Bottle-packaged soy milk is produced in the plants of local farmers' associations or small private factories. Tetra pack soy milk is produced in modern factories. The packaged soy milk may be produced by the traditional method or the modification of the Cornell method (Wilkins *et al.*, 1967) and the Illinois process (Nelson *et al.*, 1976). Soy milk prepared by the traditional method has a strong beany flavor, but it is bland when prepared by the new method. Bland soy milk is flavored with strawberry, chocolate, vanilla and peanut.

The difference between the traditional method and the modern methods lies in the heating procedure. In the Cornell method, an acceptable bland milk is produced by grinding unsoaked, dehulled soybeans with water at temperatures ranging between 80 and 100°C and maintaining the temperature for 10 min to completely inactivate the lipoxidase enzyme (Fig. 2). In the Illinois

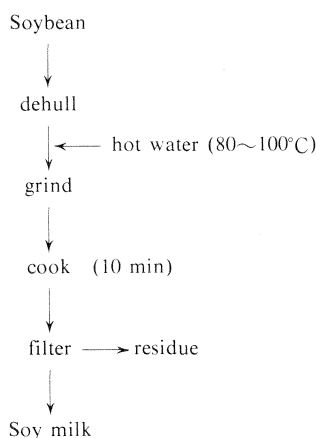


Fig. 2 Flow sheet of soy milk production by Cornell method.

process, preparation includes soaking and then blanching the whole soybeans in 0.5% sodium bicarbonate, grinding with water in a hammermill, heating the slurry to 93°C, homogenizing, neutralizing, dilution, addition of sugar and flavor, pasteurizing and re-homogenizing (Fig. 3). Enzyme inactivation by blanching prior to grinding of soaked beans is found to completely prevent the formation of painty (oxidized) flavor and results in a bland and flavored product. Liao (1980) uses deoxygenized water and steam to grind soybeans or a mixture of soybeans and peanuts. The soy milk obtained has a peanut flavor and taste, and lacks the beany flavor.

Instant soy milk powder

Last year two new brands of instant soy milk powder appeared on the market in Taiwan. One of them is produced by the traditional method to prepare soy milk, followed by spray-drying and agglomeration (Chen and Chen, 1972; Hsu, 1983) (Fig. 4). The other brand is produced by a different method; its preparation includes drying, cracking, dehulling, grinding to a very fine powder (300 mesh), mixing with water, sterilization and spray-drying (Chen, R.F., 1982) (Fig. 5). The instant soy milk powder can be flavored with cocoa (Wang *et al.*, 1976). By the separation of indigestible oligosaccharides and enrichment with vitamins and minerals, the instant soy milk powder can be used for infants (Chen *et al.*, 1979). The instant soy milk powder can also be used

to prepare tofu (Chen, 1970).

Tofu

More than 1,400 small tofu plants are located almost everywhere in Taiwan (Chiang and Huang, 1979). They produce and sell their products on the same day. Only two big modern tofu plants produce packaged and refrigerated tofu. Chinese prefer the traditional tofu which is coagulated by calcium sulfate and pressed in a cheese cloth. Many delicious Chinese foods are prepared from this kind of tofu. The soft tofu coagulated by gluconodeltalactone (GDL) or a mixture of calcium sulfate and GDL is mostly consumed in the Japanese restaurants.

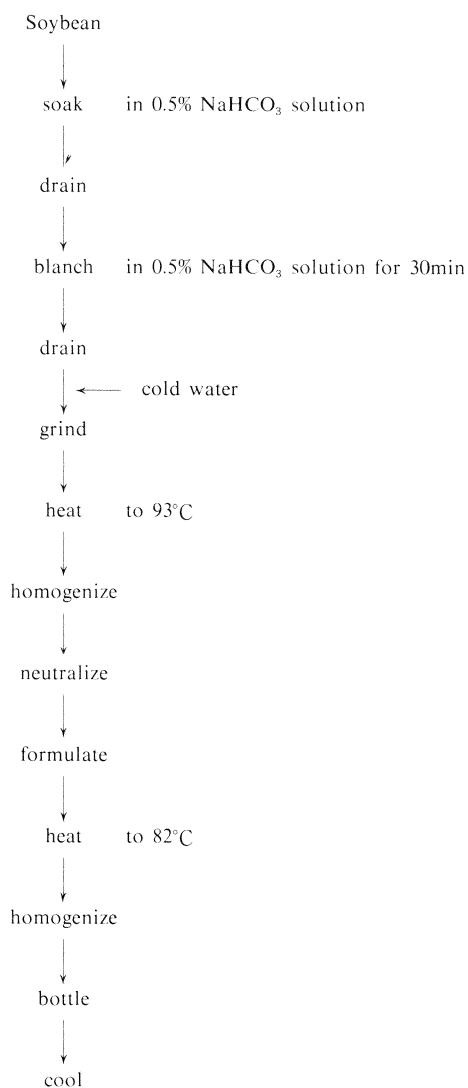


Fig. 3 Flow sheet of soy milk production by Illinois process.

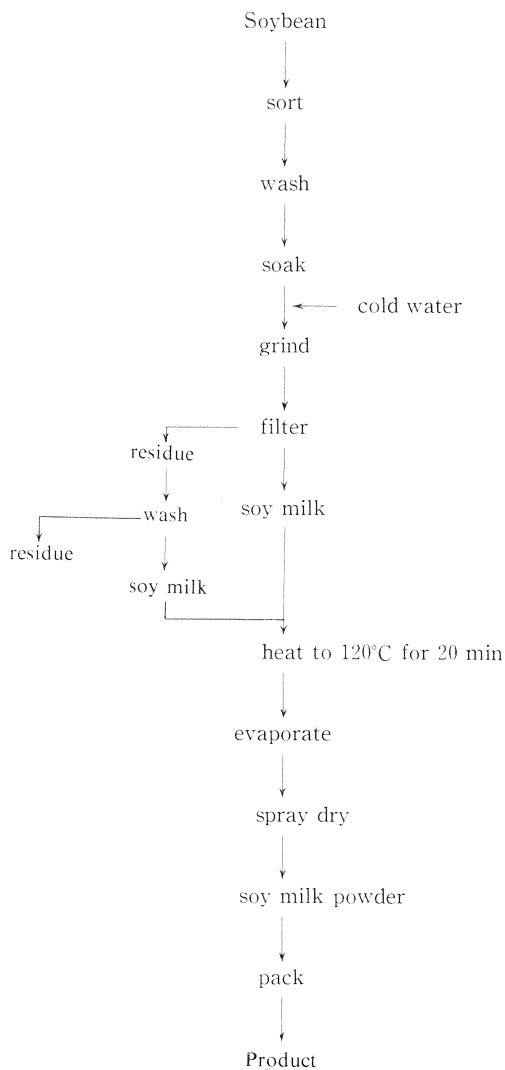


Fig. 4 Flow sheet of instant soy milk powder production (I).

Soybean pudding

This is a very soft beancurd prepared by pouring hot soy milk suddenly into a container in which there is a suspension of calcium sulfate and starch. After setting for 10 min the pudding is formed (Chen, 1979) (Fig. 6). This product is usually put in a ginger syrup with well cooked peanuts and consumed hot in winter and cold in summer. Other coagulants, such as agar-agar and carrageen, are also used for the manufacture of soybean pudding. The products have different flavors.

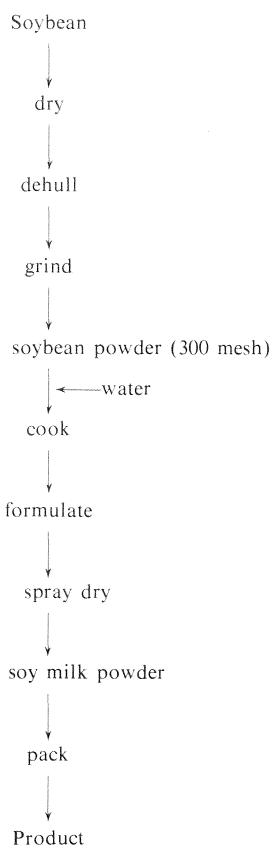


Fig. 5 Flow sheet of instant soy milk powder production (II).

Hard beancurd

This product is processed by the same method as that for tofu, but with a higher pressure and during a longer period of time. To obtain a smooth and shiny appearance, the hard beancurd is cooked in an alkaline solution for a short period of time, then colored yellow or brown with pigments. Usually, this product is cooked in meat gravy or soy sauce and sliced before consumption.

Hard beancurd thread

This product is processed by the same method as that for tofu, but only a small amount of beancurd is put in each cheese cloth to form a thin (1.5 mm) sheet of hard beancurd. The sheet is cut to threads through a cutter. This product usually is sauteed with meat and vegetables.

Spiced and dried hard beancurd

This is a snack soybean food. The hard beancurd is cut into different shapes and cooked with soy sauce, sugar, salt, spices and water. Some products are directly dried in a kettle; some are dried in a continuous hot air dryer (Fig. 7). To obtain a special chewing texture, some products are deep-fried in fat before being cooked with seasoning. The shelf life of this product is 2 to 3 months. Our

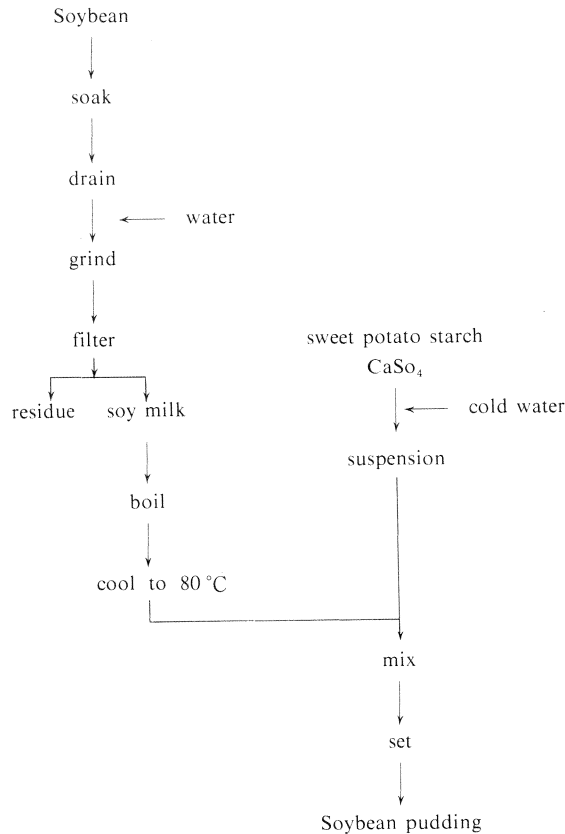


Fig. 6 Flow sheet of soybean pudding production.

Institute (FIRDI) has carried out studies and succeeded in prolonging the shelf life to 6 months (Lee *et al.*, 1983; Chen *et al.*, 1983).

Soy protein-lipid film and its products

Traditional methods of film formation consist of heating soy milk in shallow pans and periodically removing the films manually when their strength so warrants. Films are hung in the air for drying into sheets or rolls. Manufacture of vegetable-textured ham is performed with rehydrated and flavored films. The sheets are soaked in appropriate flavoring solutions such as soy or meat broths. After layering several sheets, rolling them tightly, wrapping them firmly in cloths, and tying them to retain internal pressure, the rolls are then steamed for about 1 hr and consumed as a main dish. A continuous film-forming method was developed by FIRDI (Li *et al.*, 1977) (Fig. 8). This method has been adopted by two plants already. In this method, soy milk is concentrated by isoelectric isolation. Another method to obtain soy milk at a high concentration is to grind beans with little water (bean: water=1: 3) (Chen and Lin, 1981).

Sufu (Chinese cheese)

The various processes used for the preparation of Chinese cheese by fermentation of soybean

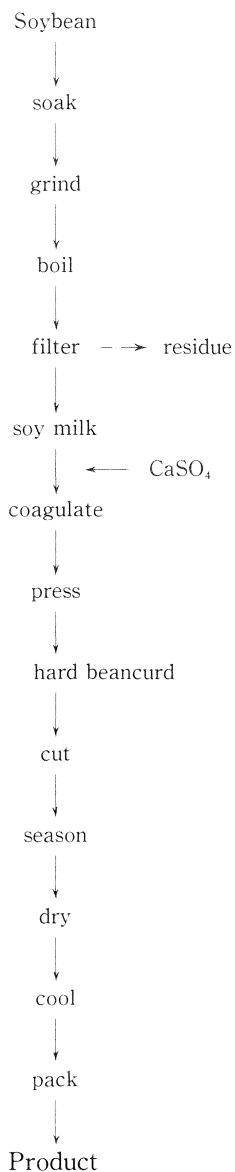


Fig. 7 Flow sheet of spiced and dried hard beancurd production.

curd with *Mucor* and other fungi were evaluated by Wai (1969). In general, sufu-making process consists of three major steps: preparation of tofu, molding process and brining process (Fig. 9). The molds belonging to the genus of *Mucor* or *Actinomucor* are usually used. The standard brining solution consists of salted-fermented rice mash, soy sauce, moromi mash, fermented soy paste, red koji or 5% NaCl solution containing rice wine having about 10% ethyl alcohol. The time of aging ranges from one to twelve months depending upon the types of brining solution. Sufu is used as a seasoning in Chinese food.

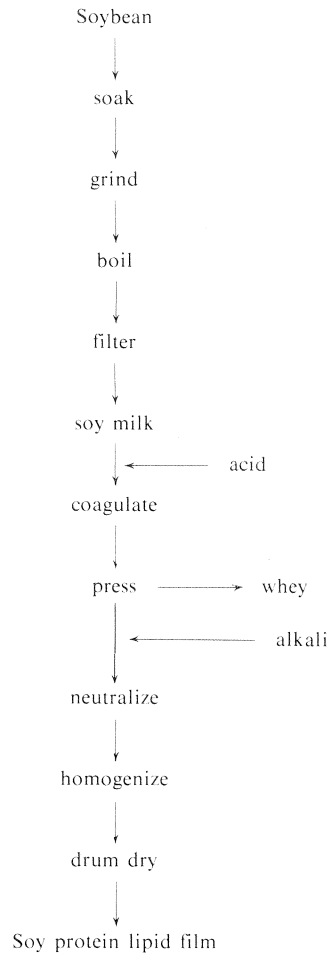


Fig. 8 Flow sheet of soy protein lipid film by drum drying.

Chou tofu (fetid tofu)

Chou tofu is also a fermented tofu. After deep frying in fat, it has a special odor and a spongy structure. Tofu used for chou tofu should be more rigid than the usual tofu. It is steepened in a fermentation liquor for 6 hr at room temperature. The fermentation liquor consists of a brining solution of pickles, dried shrimps and salted egg (Lai, 1977; Su, 1980). Chou tofu is usually eaten immediately after deep frying in fat and with pickled vegetables, chili paste and soy sauce.

Dehulled soybean powder

This product is also called active soybean powder, the enzymes being still active. Soybeans are dried under mild conditions and cracked in a mill and the hulls are removed by air separation. Finally, the dehulled soybeans are ground to a very fine powder. This product is used to prepare soy milk or soybean pudding in factories, schools and families.

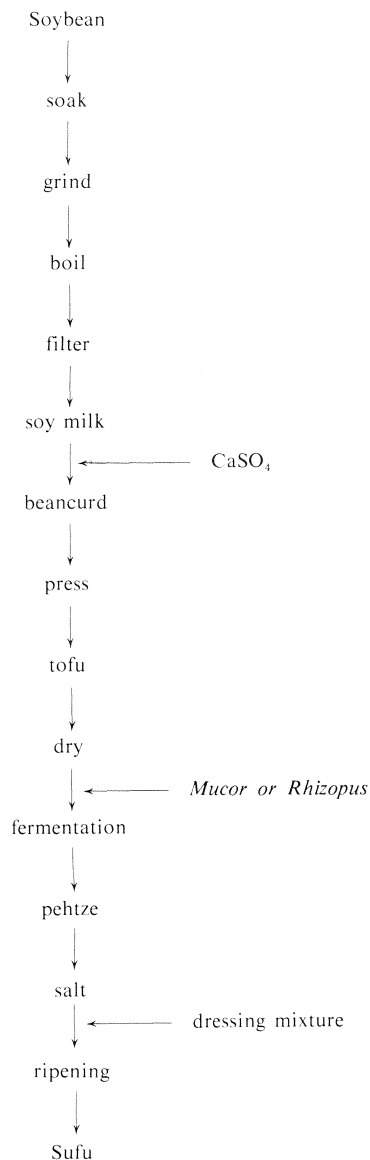


Fig. 9 Flow sheet of sufu production.

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