HOW TO PROCESS SOY IN MILK

How to Make Soy Milk

Soy milk is a high protein, iron-rich milky liquid produced from pressing ground, cooked soybeans. Creamy white soy milk resembles cow’s milk but in fact differs from its dairy counterpart in a number of ways. Not only is it higher in protein and iron content, but it is cholesterol-free, low fat, and low sodium. It is, however, lower in calcium and must be fortified with calcium when given to growing children. Those who are allergic to cow’s milk or are unable to digest lactose, the natural sugar found in cow’s milk, find soy milk easy to digest since it is lactose-free. Those who are calorie-conscious can purchase reduced fat soy milk (called lite soy milk) but this is often lower in protein as well. Some do not enjoy the taste of original soy milk, so manufacturers now offer flavored soy milk. Soy milk can be substituted for milk in nearly any recipe. Those who merely want to boost protein intake often add powdered soy milk to other beverages; others find it economical to purchase it in powder form and then make soy milk when they add water to the powder. Children under one year of age should be given a formula of soy milk specifically developed with their nutritional needs in mind. Soy milk that is intentionally curdled is known as tofu.

History

The soybean \((\text{Glycine max})\) is the world's foremost provider of protein and oil. The Chinese have been cultivating soybeans for thousands of years. The first written record of Chinese cultivation dates to the third century B.C. Many believe that the Chinese have been making soy milk for centuries—it has been sold in cafes and from street vendors for generations. So important to the Chinese are soybeans for the production of soy milk and tofu that soybeans are considered one of the five sacred grains along with rice, wheat, barley, and millet. Soybeans made their way to Japan by the sixth century and to Europe by the seventeenth century.

The beans came to the United States on ships from Asia and were used as ballast and often discarded once the ships docked. But soldiers during the Civil War substituted soy beans for coffee beans and were thus making their own form of soy beverage. By the nineteenth century, soy beverages were available in Europe as well.
However, the popularity of soybean products, including soy milk, came slowly to the United States. African-American agriculturist George Washington Carver began studying the soybean and touting its nutritive value in the early twentieth century. Shortly thereafter, doctors became intrigued with their use for its nutritional value, particularly for children unable to drink cow’s milk. Soybean production has increased in the United States throughout the twentieth century and is a staple crop for many midwestern farmers, allowing soy milk producers a steady supply of the main ingredient. Soybeans are grown in 29 states and are our second largest cash crop.

Until the 1950s, soy milk was made in small quantities at home or in small shops and was not produced on a mass scale in this country. At this time, soy milk was bottled like soft drinks. Much of the technology now used in the production of soy milk was developed by the Japanese who use soy beverages (and other soy products) in tremendous quantities. In the 1970s, when interest in soy and other non-dairy products soared, manufacturers began adding flavors to the bland soy milk. Shortly thereafter, the development of aseptic packaging (in which the milk is packaged in such a way that no air is introduced which can contain harmful bacteria) brought the beverage into the modern era.

**Raw Materials**

Soy milk requires only soybeans and water (and steam) for its creation. Soy milk is nearly always fortified with calcium, vitamins D, and certain B vitamins. Highly concentrated flavorings, such as vanilla, carob, chocolate, and almond are often added to the finished product. Many companies add sugar and salt to the drink to make it more palatable to the consumer.

**The Manufacturing Process**

The soybean is a low acid food and as such, is a good host for the breeding of harmful bacteria. Thus, the manufacturing process is "aseptic," meaning that at a certain point in its production, the soy milk is sealed off from any air because it might introduce dangerous bacteria into the product. The development of successful, affordable aseptic production of soy milk has been of tremendous importance in the
mass production of this beverage. The initial phases of the production of soy milk do not have to be sealed off to air; only later does this happen.

**Procuring the raw materials**

1. Soy milk manufacturers very often work directly with farmers so that the kind of soy bean that produces good soy milk is grown (one manufacturer gives the farmers the seeds for the soybeans they require). Generally soy milk producers seek large soybeans called clear hylem.

Once the soybeans are harvested and brought to the plant, the beans are cleaned in a grain elevator or bin on or off premises. The process may begin with the blending together of four to six tons of soybeans at one time. Some factories have two or more production lines running at one time, and thus use several tons of soybeans in a day.

**De-hulling**

2. The soybeans are steamed and split in half. This loosens the hull on the bean. A vacuum sucks off the hulls.

**Invalidating the indigestible enzyme**

3. Next, soybeans must be cooked in order to invalidate, or counteract, a specific enzyme which makes them indigestible to humans. This cooking occurs in the Enzyme Invalidator, in which the de-hulled soybeans are cooked using high pressure, Water, and high temperature (creating very hot live steam) to invalidate that enzyme.

**Rough grinding**

4. The cooked soybeans then fall into the first rough grinder or mill. Water is added to the machine and the bean pieces are roughly ground in this first milling.

**Finer grinding**
5 Although they have been ground once, the cooked soybeans are still rather coarse. Thus, the fine grinder further pulverizes the bean pellets into small particles. The hot slurry is white in color with minuscule particles of insoluble soybean particles.

**Extracting**

6 A large centrifuge is then used to extract the tiny bits of soybean that are insoluble and cannot be included in the finished product. These particles are separated from the soy milk slurry using a centrifuge. A rubber roller presses the soy milk slurry against the surface of a drum within the centrifuge, forcing the liquid inside the drum while the fibers remain on the outside of the drum. The drum is then scraped of these fibers.

These soybean fibers are physically removed from the production process at this time. This waste soy fiber is called okara and it resembles mashed potatoes. A separate process dries the okara for use other than human consumption. The fiber-less soy liquid is raw soy milk at this point and is referred to in the industry as jun.
any insoluble bits of bean. The separated soy liquid called jun is blended with vitamins, flavorings, and sugar and then sterilized and homogenized. The hot milk is cooled and packaged in such a way that it is never exposed to air.

Blending

- 7 The jun is injected into large tanks and flavorings, sugar, and vitamins are mixed separately in smaller tanks. Ingredients of the smaller tank are infused into the larger tanks, thus blending the flavors with the raw milk.

Aseptic sterilizing

- 8 At this point, it is essential that the jun be sealed within the equipment until the end of the manufacturing process (including packaging) in order to keep out air and ambient bacteria and germs that can grow in low-acid soy milk. Sterilization occurs with pressure and very hot temperatures within a vacuum for a short period of time.

Homogenizing

- 9 From the sterilizer, the hot milk is sent to the homogenizer. This breaks down the fat particles and prevents them from separating from the rest of the mixture. In the homogenizer, which is essentially a high-pressure piston pump, the milk is blended as it is drawn into the pump cylinder and then forced back out in a repetitive motion.

Cooling

- 10 Next, the hot milk is piped to the cooling tank. Here, the hot milk passes next to cold plates that lower the temperature of the soy milk to room temperature.

Storing

- 11 The cooled milk is sent to the aseptic (sealed) tanks and held here in preparation for packaging. Here, the soy milk is refrigerated, pressurized, and sealed to ensure no bacteria thrives in the milk.
Packaging

- A very important part of the production is the aseptic packaging of the product. Packaging machines have been developed for this product that are able to mechanically package the product without exposing it to air. The cooled milk is sent to this packaging machine which has a ribbon of flat packaging (cardboard) threaded into it. As the milk runs through the machine, the packaging surrounds the milk and a cutter cuts through the cardboard packaging and the milk, simultaneously folding the package and sealing the milk within it. A machine glues a plastic spout onto the sealed package. From here, the product is sent to an automatic sorter that packs a case and places it on a pallet. A modern factory is able to produce as many as 18,000 packages of soy milk in an hour.

Quality Control

Quality control begins with acquiring high quality soybean for the production of soy milk. The beans considered most desirable for the process are called clear hylem, with a white (or colorless) hylem on the body of the bean. While the soybean is generally bland, the clear hylem variety is considered more flavorful. A number of soy milk producers market their product as organic and beans purchased from farmers for soy milk must be certified organic in order to be utilized.

The production of soy milk must be meticulously monitored to ensure that no bacteria grows in the low acid medium. Thus, many factories include over 206 quality control checkpoints in this production. Temperatures of water, steam, and the monitoring of pressure is essential in this process. In addition, the product is constantly analyzed as a sample of the product is taken off the line every 10 minutes and checked for pH, temperature, and bacterial growth (many samples are cultured). Because the product is sealed off from the workers for much of the production, visual checks occur primarily as the product comes off the line. Here, workers check to ensure packages are properly sealed.

Byproducts/Waste

Until recently, the unusable okara was a significant waste problem for many soy milk production plants. Okara, the insoluble fiber that is removed from the raw soy Now,
soy milk producers send the okara to a drying machine which takes the moisture out of the okara, transforming it into a high-fiber, high-protein animal feed. The dried okara is now sold to farmers for feed, thus eliminating a storage and waste problem at most soy milk plants. It has proven to be invaluable to farmers who raise organically fed animals because many soy milk producers only take in organically grown soybeans. Thus, the dried okara feed produced from these beans is considered organic and acceptable for feed.

Where to Learn More

Books

Herbst, Sharon Tyler. *Food Lover's Companion*. Barron's Educational Services, Inc.

Other


— Nancy EV Bryk