

Soymilk

Description

Soybeans and products made from soybeans have been used as a source of protein in the diets of Asian people for many centuries¹. The utilization of soybean protein in other countries of the world is of considerable interest because... "soybeans can be grown in a variety of soils and under a wide range of climatic conditions; the yield of edible protein per acre is one of the highest of all protein sources; and this protein is of high nutritional quality."² Soymilk made from soybeans is an inexpensive source of food energy but has been unpopular in many regions of the world because of its beany flavor and odor.³

Soymilk contains protein, oil and fiber and has been used as a substitute for cow's milk for infants and young children, especially those allergic to cow's milk.⁴ Animal studies have found that soymilk has a nutritive value anywhere from 60% to 90% of cow's milk, and studies with humans indicate a nutritive equivalency between cow's milk and soymilk.⁴ The nutritive value of soymilk will depend on the method of preparation and the resulting level of protein, oil, vitamins and minerals.

Objective

The objective of preparing soymilk is to overcome the deficiencies of the traditional product. A common procedure of making soymilk includes the following steps: the beans are washed and then soaked in water for three hours or more and then separated from the water. Next, the beans and newly added water are ground into a slurry. This slurry is heated to boiling for 15-20 minutes to sterilize the product and improve nutritional value and flavor. After cooling, the slurry

is filtered using cheesecloth that separates the soymilk from the insoluble solids.

Some of the defects of this milk are as follows: beany flavor and odor (caused by the reaction of lipoxygenase (enzyme) with soybean oil), objectionable color, loss of protein and oil into the soak water, presence of trypsin inhibitor, presence of flatulence-producing sugars, poor stability with respect to separation, and poor mouth feel due to particle size.

In the past soymilk has been consumed mostly by animals and babies, what one author describes as a "non-complaining market", but to increase the acceptance of soymilk, its palatability must be improved.⁶

Processing

Many different methods have been devised for overcoming these defects (see references 5-13). The following describes a few recommended processing improvements.

Soymilk

1. Avoid soaking the beans: contact between lipoxygenase (enzyme) and oils in the bean in the presence of moisture causes a reaction producing off-flavor and odor. To avoid this, the beans are ground dry, and the resultant powder is added to hot water.^{9,11}
2. Soak the beans but keep the beans whole to avoid contact of the enzyme with the oil.⁶ Soak the beans in hot water (90°C) to inactivate the enzyme.¹⁰ Ground beans (dry) are mixed with water

inactivate the enzyme.¹⁰ Ground beans (dry) are mixed with water and then injected with steam to inactivate enzymes.^{10,11}

3. Heat the slurry to high temperature to inactivate undesirable enzymes and destroy trypsin inhibitor. The trypsin inhibitor is a naturally occurring agent that is an antinutritional factor. A heat treatment is used at some point in most processes. However, heating temperatures and times must be carefully controlled to avoid denaturing or insolubilizing proteins.

4. Do not separate the solids from the slurry in order to increase the amount of protein and oil in the final milk. This requires more thorough grinding and size reduction of the solids. Efficient comminution can be accomplished by pre-grinding the slurry and by homogenizing the milk with a Gaulin homogenizer^{3,5, 6,7,9,12} Homogenization reduces particle size, which improves the mouth feel, eliminates settling and separation of the milk, and emulsifies the soybean oils into the product. Once homogenized, the oil in the milk is strongly complexed with protein.

The conditions of homogenization depend on the process. The pressure used may vary from 2500 psi to 8000 psi, and the number of passes range from one to three.

5. Add various ingredients to the soymilk at different stages in the process. Enzymes have been added to break down flatulence causing sugars: emulsion eliminates stachyose; invertase or alpha-galactosidase eliminates raffinose. Also the enzyme pectinase is added to hydrolyze pectin and cellulase or hemicellulase is used to hydrolyze cellulose.⁹ Emulsifiers, gums and vegetable oils have been added to soymilk in different processes to improve stability and to eliminate separation of solids.^{3,12}

6. Remove hulls from the beans which results in a lower viscosity product with a whiter color but with a lower fiber content.

The following describes a protocol containing elements from the different processes for making soymilk. Do not break or grind the beans before they are soaked. Soaking is needed to tenderize the beans. Soak water may contain chemicals to adjust pH or to deoxygenate the water.^{6,13} The soak water is drained and fresh water

added. Heat to 90°C-100°C to inactivate enzymes (blanching). This water is drained and the beans dehulled, if necessary. Add fresh water, then grind into a slurry. Homogenize the product with a Gaulin homogenizer and then add flavoring, sugar, salt, etc., if necessary. Pasteurize the soymilk. Of course, using a process described in a patent may require licensing agreement with the inventor.

References:

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