

A Process for Preparing Soymilk, Soymilk as Obtained and Use Thereof in Food Products

TECHNICAL FIELD

[0001] The present invention particularly relates to a process for preparing soymilk, and to the soymilk as prepared and its use in food products, which belongs to the field of food technology.

BACKGROUND

[0002] Generally, the current processes for preparing soymilk include procedures such as soybean selection, washing, soaking, milling, separation, enzyme inactivation, homogenization, and sterilization. Among them, the main purpose of enzyme inactivation is to inactivate anti-nutritional factors such as trypsin inhibitors and rennin contained in soybeans, so as to retain the nutrients in soybeans to a greater extent.

[0003] Currently, the protein content of the soymilk and soymilk-based beverages available on the domestic market is generally much lower than 6%. Moreover, the soymilk and soymilk-based beverages produced by the existing technologies also have problems such as thick-greasy mouthfeel, poor freshness, heavy beany flavor, poor drinking taste and drinking experience. In addition, the soymilk products produced by the existing technologies have many sediments during the shelf life and thus have poor product stability, which affects the product quality.

[0004] Therefore, there is an urgent need for a process for preparing soymilk that can increase the protein content of the product, improve freshness of the product, weaken the thick-greasy mouthfeel and the beany flavor and improve the stability of the product.

SUMMARY

[0005] The soymilk prepared by the process according to the present invention has fresh mouthfeel, little greasiness and beany flavor, and good taste. The soymilk product has a high protein content of 6% or more, low sediment content and high product stability. On this basis, the present invention provides a soymilk product as prepared and its use in food products.

[0006] In a first aspect of the present invention, there is provided a process for preparing soymilk, comprising the steps of:

[0007] (1) soaking soybeans with a liquid enzymic preparation to obtain a mixed material, wherein the liquid enzymic preparation contains a pectinase, a cellulase and water;

[0008] (2) subjecting the mixed material to a pulp-milling treatment, to obtain a first milled material;

[0009] (3) subjecting the first milled material to a pulp-milling treatment, to obtain a second milled material;

[0010] (4) subjecting the second milled material to an enzyme-inactivation treatment, to obtain an enzyme-inactivated product;

[0011] (5) subjecting the enzyme-inactivated product to a solid-liquid separation, and collecting the liquid phase;

[0012] (6-1) subjecting the liquid phase to an enzyme-inactivation treatment, to obtain a first product.

[0013] In some embodiments according to the first aspect of the present invention, the first product is soymilk, or the first product is further processed to obtain soymilk.

[0014] In some embodiments according to the first aspect of the present invention, in step (2), the pulp-milling treatment is a coarse milling treatment, and the obtained first milled material is a coarse milled material in which the particle size of the particulate matter is not less than 100 mesh.

[0015] In some embodiments according to the first aspect of the present invention, in step (3), the pulp-milling treatment is a fine milling treatment, and the obtained the second milled material that is a fine milled material in which the particle size of the particulate matter is 230 to 180 mesh, for example, 220 mesh, 200 mesh, 190 mesh.

[0016] In some embodiments according to the first aspect of the present invention, in step (1), the process comprises one or more of the following A to E:

[0017] A. the liquid enzymic preparation has a total content of the pectinase and the cellulase of 10^{-5} to 10^{-3} g per liter, for example 10^{-4} g per liter;

[0018] B. the liquid enzymic preparation has a weight ratio of the pectinase to the cellulase of 1: (0.8 to 5), such as 1:1, 1:2, 1:3, 1:4;

[0019] C. the pectinase is selected from polygalacturonase and α -N-arabinofuranosidase;

[0020] D. the pectinase is produced by fermentation of *Aspergillus niger*;

[0021] E. the cellulase is produced by fermentation of *Trichoderma longibrachiatum*.

[0022] In some embodiments according to the first aspect of the present invention, *Aspergillus niger* and *Trichoderma longibrachiatum* may be commercially available.

[0023] In some embodiments according to the first aspect of the present invention, the process further comprises a step of: (7) continuously stirring the first product at 2°C to 15°C (e.g., 3°C, 5°C, 7°C, 9°C, 10°C, 11°C, 12°C, 14°C) for 2 to 10 hours (e.g., 4 hours, 5 hours, 7 hours, 8 hours, 9 hours) to obtain a second product.

[0024] In some embodiments according to the first aspect of the present invention, the second product is soymilk, or is further processed to obtain soymilk.

[0025] In some embodiments according to the first aspect of the present invention, in step (7), the stirring is carried out at a speed of 100 to 700 rpm, such as 200 rpm, 300 rpm, 400 rpm, 500 rpm, 600 rpm.

[0026] In some embodiments according to the first aspect of the present invention, a step (6-2) of degassing the first product to obtain a degassed material is further included between steps (6-1) and (7).

[0027] In some embodiments according to the first aspect of the present invention, in step (6-2), the first product is degassed until no more air bubbles generated in the first product to obtain the degassed material.

[0028] In some embodiments according to the first aspect of the present invention, the degassing treatment is carried out at a temperature of 75°C to 95°C, such as 80°C, 85°C, 90°C.

[0029] In some embodiments according to the first aspect of the present invention, the degassing treatment is carried out at a pressure of -0.5 to -0.1 bar, such as -0.4 bar, -0.3 bar, -0.2 bar.

[0030] In some embodiments according to the first aspect of the present invention, a step (6-3) of homogenizing the degassed material to obtain a homogenized material is further included between steps (6-2) and (7).

[0031] In some embodiments according to the first aspect of the present invention, the homogenization treatment is carried out at a temperature of 65°C to 85°C, such as 70°C, 75°C, 80°C.

[0032] In some embodiments according to the first aspect of the present invention, the homogenization treatment is carried out at a pressure of 300 to 500 bar, such as 350 bar, 400 bar, 450 bar.

[0033] In some embodiments according to the first aspect of the present invention, the degassed material obtained in step (6-2) or the homogenized material obtained in step (6-3) is subjected to the stirring in step (7).

[0034] In some embodiments according to the first aspect of the present invention, the process further comprises, prior to step (1), a pre-treatment step of: baking the soybeans and dehulling the baked soybeans to obtain dehulled soybeans.

[0035] In some embodiments according to the first aspect of the present invention, the process comprises one or more of the following (A) to (D):

[0036] (A) the baking is carried out at a temperature of 95°C to 140°C, such as 100°C, 110°C, 120°C, 130°C;

[0037] (B) the baking is carried out for a period of 100 to 200 seconds, such as 120 seconds, 140 seconds, 150 seconds, 160 seconds, 170 seconds, 180 seconds, 190 seconds;

[0038] (C) prior to the dehulling, the baked soybeans are cooled; more preferably, the baked soybeans are cooled to 35°C or less, such as 30°C or less, 28°C, 20°C, 15°C, 10°C;

[0039] (D) the dehulling is carried out by means of a vacuum vibratory dehuller.

[0040] In some embodiments according to the first aspect of the present invention, the baking is carried out by using a hot air baking oven.

[0041] In some embodiments according to the first aspect of the present invention, the baked soybeans have a dry surface and a cracked skin.

[0042] In some embodiments according to the first aspect of the present invention, the dehulled soybeans are soybean flakes.

[0043] In some embodiments according to the first aspect of the present invention, the dehulled soybeans as obtained are used for the pulp-milling treatment in step (1).

[0044] In some embodiments according to the first aspect of the present invention, in step (4), the enzyme-inactivation treatment is an enzyme-inactivation treatment by steam, which is carried out at a temperature of 40°C to 65°C (e.g., 45°C, 50°C, 55°C, 60°C) for a period of 110 to 200 seconds (e.g., 120 seconds, 140 seconds, 160 seconds, 170 seconds, 180 seconds, 190 seconds).

[0045] In some embodiments according to the first aspect of the present invention, in step (4), the enzyme-inactivation treatment is carried out at a steam pressure of 0.05 to 0.25 MPa, such as 0.1 MPa, 0.2 MPa.

[0046] In some embodiments according to the first aspect of the present invention, in step (6-1), the enzyme-inactivation treatment is an enzyme-inactivation treatment by steam carried out at a temperature of 100°C to 150°C (e.g., 105°C, 110°C, 115°C, 120°C, 125°C, 130°C, 135°C, 140°C, 145°C) for a period of 40 to 180 seconds (e.g., 50 seconds, 60 seconds, 70 seconds, 80 seconds, 90 seconds, 100 seconds, 120 seconds, 130 seconds, 150 seconds, 160 seconds, 170 seconds).

[0047] In some embodiments according to the first aspect of the present invention, in step (6-1), the enzyme-inactivation treatment is carried out at a steam pressure of 0.3 to 3 MPa, such as 0.4 MPa, 0.6 MPa, 0.8 MPa, 1 MPa, 1.2 MPa, 1.5 MPa, 1.7 MPa, 2 MPa, 2.2 MPa, 2.4 MPa, 2.6 MPa, 2.8 MPa.

[0048] In some embodiments according to the first aspect of the present invention, the process comprises the following a to i:

[0049] a. in step (2), the pulp-milling treatment is carried out at a temperature of 35°C to 65°C, such as 40°C, 45°C, 50°C, 55°C, 60°C;

[0050] b. in step (3), the pulp-milling treatment is carried out at a temperature of 35°C to 65°C, such as 40°C, 45°C, 50°C, 55°C, 60°C;

[0051] c. in step (1), the soaking is carried out at a temperature of 35°C to 65°C, such as 35°C,

40°C, 45°C, 50°C, 55°C, 60°C;

[0052] d. in step (1), the soaking is carried out for a period of 1 to 30 minutes, for example, 5 minutes, 10 minutes, 15 minutes, 20 minutes, 25 minutes;

[0053] e. in step (1), the weight ratio of soybean to the liquid enzymic preparation is 1: (1 to 10), for example, 1:2, 1:4, 1:5, 1:7, 1:8, 1:9;

[0054] f. in step (2), the particulate matter in the first milled material has a particle size of not less than 100 mesh;

[0055] g. in step (3), the particulate matter in the second milled material has a particle size of 230 to 180 mesh, such as 220 mesh, 200 mesh;

[0056] h. in step (5), the solid-liquid separation is carried out by means of a slurry separator;

[0057] i. the process further comprises a step (8): subjecting the first product or second product to a sterilization treatment.

[0058] In some embodiments according to the first aspect of the present invention, in step (8), the first product or second product is subjected to a steam-infusion sterilization treatment.

[0059] In some embodiments according to the first aspect of the present invention, the steam-infusion sterilization treatment is carried out at a temperature of 110°C to 150°C, such as 120°C, 130°C, 140°C.

[0060] In some embodiments according to the first aspect of the present invention, the steam-infusion sterilization treatment is carried out for a period of 2 seconds to 1 minute, for example, 5 seconds, 10 seconds, 20 seconds, 30 seconds, 40 seconds, 50 seconds.

[0061] In some embodiments according to the first aspect of the present invention, the sterilized product is soymilk.

[0062] In a second aspect of the present invention, there is provided a soymilk, prepared by the process described in the first aspect according to the present invention.

[0063] In some embodiments according to the second aspect of the present invention, the soymilk has a protein content of not less than 6% by weight, such as not less than 6.1%, not less than 6.2%, not less than 6.3%.

[0064] In some embodiments of a second aspect according to the present invention, the soymilk has a sediment content of not more than 5% by weight, for example not more than 4%, not more than 3%.

[0065] In some embodiments according to the second aspect of the present invention, the soymilk has a shelf life of not less than half a year.

[0066] In a third aspect of the present invention, there is provided a soymilk beverage comprising soymilk as described in the second aspect according to the present invention, optionally fat-

providing sources, optionally carbohydrate-providing sources, optionally food additives, and optionally water.

[0067] In some embodiments according to the third aspect of the present invention, the fat-providing sources include, but are not limited to, vegetable fats and animal fats.

[0068] In some embodiments according to the third aspect of the present invention, the carbohydrate-providing sources include, but are not limited to, maltodextrin, malt oligosaccharides, sugar, and starch.

[0069] In some embodiments according to the third aspect of the present invention, the food additives include, but are not limited to, preservatives, thickeners, sweeteners, emulsifiers, nutrient supplements, flavoring agents, and perfumes.

[0070] In the present invention, water is selected from distilled water, deionized water, pharmaceutical water, tap water, purified water, and mineral water.

[0071] In a fourth aspect of the present invention, there is provided the use of the soymilk as described in the second aspect according to the present invention in the preparation of soymilk beverages.

[0072] In the present invention, if not otherwise specified,

[0073] the term "soymilk", also known as bean milk, is a product made from soybeans as raw materials, processed by steps such as enzyme inactivation, milling, deslagging, deodorization, homogenization, sterilization and the like, wherein food excipients and food additives are generally not added during the process;

[0074] the term "pectinase" refers to a class of enzymes that breaks down pectin, a major component of plants;

[0075] the term "cellulase" is a generic term for a group of enzymes that catalyze the degradation of cellulose to produce glucose and low-polymerized fibers;

[0076] the term "polygalacturonase" is a cell wall-binding protein that catalyzes the cleavage of α -(1,4)-polygalacturonic acid in pectin molecules, which participates in pectin degradation and disintegrates the cell wall structure, leading to fruit softening;

[0077] the term "*Aspergillus niger*" is a common species of *Aspergillus* fungus in Subphylum Deuteromycetes, Class Hyphomycetes, Order Moniliales, family Moniliaceae, and Genus *Aspergillus*, which is widely distributed around the world in food, plant products and soil, and is an important fermentation strain in industries;

[0078] the term "*Trichoderma longibrachiatum*" belongs to the Phylum Deuteromycetes, which is white, dense and round and expands in all directions in the beginning, and after growing for a period, green spores are produced from the center of the colony, and it turns green in the center;

the colony grows rapidly, has obvious whorls, and is surrounded by a growth band of white mycelium; finally the whole colony become green;

[0079] the term "enzyme inactivation by steam" refers to the treatment in which the enzyme is inactivated by spraying hot steam to the sample to be treated, or placing the sample to be treated in a hot steam environment;

[0080] the term "steam-infusion sterilization" refers to the treatment in which the sample to be treated is immersed in hot steam for sterilization;

[0081] the term "enzymic preparation" refers to a product produced using enzymes.

[0082] The present invention can obtain at least one of the following beneficial effects.

[0083] 1. The soymilk prepared by the process according to the present invention has fresh mouthfeel, little greasiness and beany flavor, and good taste.

[0084] 2. The soymilk prepared by the process according to the present invention has a high protein content of 6% or more.

[0085] 3. The soymilk prepared by the process according to the present invention has low sediment content, good product stability and long shelf life.

[0086] 4. The process according to the invention has high stability and stable product quality, and is suitable for continuous industrial production.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0087] Embodiments of the present invention will be clearly and completely described below in connection with the examples, and it is clear that the examples described are only a portion of the embodiments of the invention, rather than all of the embodiments. The following description of at least one exemplary embodiment is in fact merely illustrative and in no way serves as any limitation on the present invention and its application or use. Based on the embodiments in the present invention, all other embodiments obtained by a person of ordinary skill in the art without creative labor are within the scope of protection of the present invention.

[0088] Enzymic preparation having an enzyme content of 0.01% (g/L) is prepared by mixing a pectinase, a cellulase and distilled water, in which the weight ratio of the pectinase to the cellulase was (40-50): (60-50), the pectinase was polygalacturonase and α -N-arabinofuranosidase (the ratio of polygalacturonase to α -N-arabinofuranosidase is not specified) produced by fermentation of *Aspergillus niger*, and the cellulase was produced by fermentation of *Trichoderma longibrachiatum*.

[0089] Water with a pH of 7.0 to 7.5 were obtained by adding a 0.05% (W/W) of sodium bicarbonate solution to distilled water to adjust the pH value.

[0090] Example 1

[0091] (1) 10 kg of soybeans subjected to de-hybridization and screening were baked by a hot air baking oven, at a temperature of 110°C for a period of 120 seconds. After cooling to 30°C, the soybeans were dehulled using a vacuum vibratory peeling machine to obtain dehulled soybeans.

[0092] (2) The dehulled soybeans were soaked with an enzymic preparation containing 0.01% (g/L) enzymes, in which the weight ratio of dehulled soybeans to enzymes was 1:4.5, at a temperature of 55°C for a period of 10 minutes to obtain a mixed material.

[0093] (3) The mixed material was coarsely milled through a first pulp milling machine at 50°C, to obtain a coarse milled material, in which the particulate matter had a particle size of 100 mesh or more.

[0094] (4) Next, the coarse milled material was finely milled through a second pulp milling machine at 50°C, to obtain a fine milled material, in which the particulate matter had a particle size of about 200 mesh.

[0095] (5) The fine milled material was subjected to an enzyme-inactivation treatment by steam using a steam enzyme-inactivation machine, at a temperature of 50°C and a pressure of 0.1 MPa (atmospheric pressure) for a period of 140 seconds to obtain a first product.

[0096] (6) The first product was separated through a slurry separator to collect the isolated slurry.

[0097] (7) The slurry was subjected to a second enzyme-inactivation treatment by steam using the steam enzyme-inactivation machine at a temperature of 120°C and a pressure of 0.6 MPa for a period of 90 seconds to obtain a second product.

[0098] (8) The second product was degassed at 85°C at a pressure of -0.3 bar, to obtain a degassed material in which no obvious bubbles appeared.

[0099] (9) The degassed material was homogenized at a temperature of 73°C and a pressure of 400 bar, to obtain a homogenized material.

[00100] (10) The homogenized material was stirred at 4°C to 12°C with a speed of 300 rpm for 4 hours, to obtain a cooked material.

[00101] (11) The cooked material was subjected to a steam-infusion sterilization at a temperature of 138°C for a period of 12 seconds, to obtain a soymilk product 1 for subsequent canning and delivery.

[00102] Example 2

[00103] (1) 10 kg of soybeans subjected to de-hybridization and screening were baked by a hot air baking oven, at a temperature of 110°C for a period of 120 seconds. After cooling to 30°C, the

soybeans were dehulled using a vacuum vibratory peeling machine to obtain dehulled soybeans.

[00104] (2) The dehulled soybeans were soaked with an enzymic preparation containing 0.01% (g/L) enzymes, in which the weight ratio of dehulled soybeans to enzymes was 1:4.5, at a temperature of 50°C for a period of 15 minutes to obtain a mixed material.

[00105] (3) The mixed material was coarsely milled through a first pulp milling machine at 50°C, to obtain a coarse milled material, in which the particulate matter had a particle size of 100 mesh or more.

[00106] (4) Next, the coarse milled material was finely milled through a second pulp milling machine at 50°C, to obtain a fine milled material, in which the particulate matter had a particle size of about 200 mesh.

[00107] (5) The fine milled material was subjected to an enzyme-inactivation treatment by steam using a steam enzyme-inactivation machine, at a temperature of 50°C and a pressure of 0.1 MPa (atmospheric pressure) for a period of 140 seconds to obtain a first product.

[00108] (6) The first product was separated through a slurry separator to collect the isolated slurry.

[00109] (7) The slurry was subjected to a second enzyme-inactivation treatment by steam using the steam enzyme-inactivation machine at a temperature of 120°C and a pressure of 0.6 MPa for a period of 90 seconds to obtain a second product.

[00110] (8) The second product was degassed at 85°C at a pressure of -0.3 bar, to obtain a degassed material in which no obvious bubbles appeared.

[00111] (9) The degassed material was homogenized at a temperature of 73°C and a pressure of 400 bar, to obtain a homogenized material.

[00112] (10) The homogenized material was stirred at 4°C to 12°C with a speed of 300 rpm for 4 hours to obtain a cooked material.

[00113] (11) The cooked material was subjected to a steam-infusion sterilization at a temperature of 138°C for a period of 12 seconds, to obtain a soymilk product 2 for subsequent canning and delivery.

[00114] Example 3

[00115] (1) 10 kg of soybeans subjected to de-hybridization and screening were baked by a hot air baking oven, at a temperature of 110°C for a period of 120 seconds. After cooling to 30°C, the soybeans were dehulled using a vacuum vibratory peeling machine to obtain dehulled soybeans.

[00116] (2) The dehulled soybeans were soaked with an enzymic preparation containing 0.01% (g/L) enzymes, in which the weight ratio of dehulled soybeans to enzymes was 1:4.5, at a temperature of 55°C for a period of 10 minutes to obtain a mixed material.

[00117] (3) The mixed material was coarsely milled through a first pulp milling machine at 50°C, to obtain a coarse milled material, in which the particulate matter had a particle size of 100 mesh or more.

[00118] (4) Next, the coarse milled material was finely milled through a second pulp milling machine at 50°C, to obtain a fine milled material, in which the particulate matter had a particle size of about 200 mesh.

[00119] (5) The fine milled material was subjected to enzyme-inactivation treatment by steam using a steam enzyme-inactivation machine, at a temperature of 50°C and a pressure of 0.1 MPa (atmospheric pressure) for a period of 150 seconds to obtain a first product.

[00120] (6) The first product was separated through a slurry separator to collect the isolated slurry.

[00121] (7) The slurry was subjected to a second enzyme-inactivation treatment by steam using the steam enzyme-inactivation machine at a temperature of 120°C and a pressure of 0.6 MPa for a period of 80 seconds to obtain a second product.

[00122] (8) The second product was degassed at 85°C at a pressure of -0.3 bar, to obtain a degassed material in which no obvious bubbles appeared.

[00123] (9) The degassed material was homogenized at a temperature of 73°C and a pressure of 400 bar, to obtain a homogenized material.

[00124] (10) The homogenized material was stirred at 4°C to 12°C with a speed of 300 rpm for 4 hours to obtain a cooked material.

[00125] (11) The cooked material was subjected to steam-infusion sterilization at a temperature of 138°C for a period of 12 seconds, to obtain a soymilk product 3 for subsequent canning and delivery.

[00126] Comparative Example 1

[00127] The process was carried out in the same manner as those in Example 1, except that the enzymic preparation in step (2) is replaced by water having a pH of 7.0 to 7.5 in an equal amount to, obtain a soymilk product A.

[00128] Comparative Example 2

[00129] The process was carried out in the same manner as those in Example 1, except that the step (10) was omitted and the homogenized material was directly subjected to the steam-infusion sterilization, to obtain a soymilk product A.

[00130] Comparative Example 3

[00131] 10 kg of soybeans subjected to de-hybridization and screening were cleaned by water with

a pH of 7.0 to 7.5 at 40°C to 45°C, but not dehulled. Next, the cleaned, non-dehulled soybeans were treated according to steps (2) to (11) in Example 1 to obtain a soymilk product C.

[00132] Comparative Example 4

[00133] The process was carried out in the same manner as those in Example 1, except that the enzyme-inactivation treatment by steam in step (5) was carried out at a temperature adjusted to 75°C to 85°C for a period adjusted to 60 seconds, and the enzyme-inactivation treatment by steam in step (7) was carried out for a period adjusted to 180 seconds, to obtain a soymilk product D.

[00134] Comparative Example 5

[00135] The process was carried out in the same manner as those in Example 1, except that both the coarse milling in step (3) and the fine milling in step (4) were carried out at a temperature adjusted to 85°C, to obtain a soymilk product E.

[00136] Comparative Example 6

[00137] The process was carried out in the same manner as those in Example 1, except that the steam-infusion sterilization in step (11) was replaced by a tubular ultra-high temperature sterilization at the same temperature and period as in Example 1, to obtain a soymilk product F.

[00138] Test Example 1. Measurement of the protein content in products

[00139] The protein contents by weight in soymilk products 1 to 3 and soymilk products A to F were measured by using a milk composition analyzer, and the results are shown in Table 1.

[00140] Table 1

Sample No.	Protein Content, by weight (%)
Soymilk product 1	6.35
Soymilk product 2	6.35
Soymilk product 3	6.31
Soymilk product A	6.35
Soymilk product B	6.35
Soymilk product C	5.67
Soymilk product D	6.21
Soymilk product E	5.54
Soymilk product F	6.27

[00141] As can be seen from Table 1, the protein content in the soymilk products prepared by the process according to the present invention was significantly higher than that in the soymilk products C to E, which indicates that the process according to the present invention may remarkably improve the protein content in soymilk. Meanwhile, the protein content in the soymilk products is not affected by soaking with enzymes, absence of cooking treatment, and the use of tubular ultra-high temperature sterilization.

[00142] Test Example 2. Evaluation of product taste

[00143] 10 trained technicians were invited to taste the soymilk products 1 to 3 and soymilk products A to F, and then provide scores in the four technical indicators of taste preference, freshness, greasiness and beany flavor according to the method in national standard GB12315. Average scores were taken, and the results thereof are shown in Table 2.

[00144] The taste preference has a maximum score of 5. A higher score indicates a high taste preference.

[00145] The freshness has a maximum score of 5. A higher score indicates a high freshness.

[00146] The greasiness has a maximum score of 5. A lower score indicates a low greasiness, and vice versa.

[00147] The beany flavor has a maximum score of 5. A lower score indicates a weak beany flavor, and vice versa.

[00148] Table 2

Sample No.	Taste preference	Freshness	Greasiness	Beany flavor
Soymilk product 1	4.83	3.91	2	1.6
Soymilk product 2	4.43	3.88	2.1	1.7
Soymilk product 3	4.54	3.67	2.3	1.7
Soymilk product A	4.62	2.17	4.64	1.89
Soymilk product B	3.67	2.10	3.22	4.21
Soymilk product C	3.54	1.98	4.65	4.45
Soymilk product D	4.59	2.23	3.13	1.90
Soymilk product E	4.45	3.01	2.2	1.7
Soymilk product F	4.22	1.89	4.3	2.45

[00149] As can be seen from Table 2, compared with the soymilk products A to F, the soymilk products prepared by the process according to the present invention had a more popular taste and

higher freshness. Compared with the soymilk products A to D and F, the soymilk products prepared by the process according to the present invention had lower greasiness and lower beany flavor. This indicates that the process according to the present invention can significantly improve the product taste, increase the fresh mouthfeel of the products and remarkably weaken the greasiness and beany flavor of the products.

[00150] Test Example 3. Evaluation on the process stability

[00151] The operating stability of the sterilization devices in Example 1 and Comparative Example 6 was detected, and the results are shown in Table 3.

[00152] 100 g of soymilk products 1 to 3 and 100 g of soymilk product F are sampled respectively. Then, the samples were centrifuged at a speed of 1500G for 10 minutes to separate a solid phase, which was dried at 80°C for 5 hours, to obtain the weight of dried material, m (g). The sedimentation rate was calculated according to the following equation, and the results are shown in Table 4.

[00153] Sedimentation rate = $100\% \times m / 100$

[00154] Table 3

Operation time (mins)	Measured temperature of the sterilization device in Example 1 (°C)	Measured temperature of the sterilization device in Comparative Example 6 (°C)
0	138.0	138.0
10	138.0	138.0
20	138.0	138.1
30	138.0	138.1
40	138.0	138.4
50	138.1	138.5
60	138.0	138.7
80	138.0	139.2
100	138.0	140.4
120	138.0	141.0
180	138.0	142.5
240	138.1	143.0
300	138.0	144.1
360	138.0	146.0
420	138.0	147.5
480	138.0	—

[00155] Table 4

Sample No.	Sedimentation rate (%)
Soymilk product 1	1.21
Soymilk product 2	1.24
Soymilk product 3	1.33
Soymilk product F	10.01

[00156] As can be seen from Tables 3 to 4, the steam infusion sterilization process used in the present invention can stably maintain the operating temperature and had better process stability, as compared with the tubular ultra-high temperature sterilization process in Comparative Example 6. The soymilk product prepared by the process according to the present invention had a lower sedimentation rate than the soymilk product F, which indicates that the process stability of the process according to the present invention is better.

[00157] Test Example 4. The test on product stability

[00158] The sealed packaged soymilk products 1 to 3 and soymilk products A to F were left to stand at room temperature for 6 months, and then the stability of the products was evaluated. The results are shown in Table 5.

[00159] Table 5

Sample No.	Evaluation result
Soymilk product 1	Good stability
Soymilk product 2	Good stability
Soymilk product 3	Good stability
Soymilk product A	Good stability
Soymilk product B	Good stability
Soymilk product C	Good stability, minor sediments in the bottom
Soymilk product D	Good stability, minor sediments in the bottom
Soymilk product E	Good stability, minor sediments in the bottom
Soymilk product F	Poor stability, obvious sediments in the bottom

[00160] As can be seen from Table 5, the soymilk products prepared by the process according to the present invention had better stability, as compared with soymilk products C to F, which indicates that the process according to the present invention can significantly improve the stability

of the products.

[00161] Obviously, the above embodiments are only examples made for clear illustration, and are not a limitation of implementation. For a person of ordinary skill in the art, other variations or modifications can be made in different forms based on the above description. It is not necessary or possible to exhaust all embodiments here. The obvious variations or modifications derived therefrom are still within the protection scope created by the present invention.

CLAIMS

1. A process for preparing soymilk, comprising the steps of:

(1) soaking soybeans with a liquid enzymic preparation to obtain a mixed material, wherein the liquid enzymic preparation contains a pectinase, a cellulase and water;

(2) subjecting the mixed material to a pulp-milling treatment, to obtain a first milled material;

(3) subjecting the first milled material to a pulp-milling treatment, to obtain a second milled material;

(4) subjecting the second milled material to an enzyme-inactivation treatment, to obtain an enzyme-inactivated product;

(5) subjecting the enzyme-inactivated product to a solid-liquid separation, and collecting the liquid phase;

(6-1) subjecting the liquid phase to an enzyme-inactivation treatment, to obtain a first product.

2. The process according to claim 1, wherein, step (1) is characterized by one or more of the following A to E:

A. the liquid enzymic preparation has a total content of the pectinase and the cellulase of 10^{-5} to 10^{-3} g per liter;

B. the liquid enzymic preparation has a weight ratio of the pectinase to the cellulase of 1: (0.8 to 5);

C. the pectinase is selected from polygalacturonase and α -N-arabinofuranosidase;

D. the pectinase is produced by fermentation of *Aspergillus niger*;

E. the cellulase is produced by fermentation of *Trichoderma longibrachiatum*.

3. The process according to claim 1, further comprising, a step of:

(7) continuously stirring the first product at 2°C to 15°C for 2 to 10 hours to obtain a second product.

4. The process according to claim 3, wherein, in step (7), the stirring is carried out at a speed of 100 to 700 rpm.

5. The process according to claim 3, wherein a step (6-2) of degassing the first product to obtain a degassed material is further included between steps (6-1) and (7).

6. The process according to claim 5, wherein, in step (6-2), the degassing treatment is carried out at a temperature of 75°C to 95°C.

7. The process according to claim 5, wherein, in step (6-2), the degassing treatment is carried out at a pressure of -0.5 to -0.1 bar.

8. The process according to claim 5, wherein, a step (6-3) of homogenizing the degassed material to obtain a homogenized material is further included between steps (6-2) and (7).

9. The process according to claim 8, wherein, in step (6-3), the homogenization treatment is carried out at a temperature of 65°C to 85°C.

10. The process according to claim 8, wherein, in step (6-3), the homogenization treatment is carried out at a pressure of 300 to 500 bar.

11. The process according to claim 1, further comprising, prior to step (1), a pre-treatment step of:

baking the soybeans and dehulling the baked soybeans to obtain dehulled soybeans.

12. The process according to claim 11, characterized by one or more of the following (A) to (D):

(A) the baking is carried out at a temperature of 95°C to 140°C;

(B) the baking is carried out for a period of 100 to 200 seconds;

(C) the baked soybeans are cooled prior to dehulling;

(D) the dehulling is carried out by means of a vacuum vibratory dehuller.

13. The process according to claim 12, wherein, in (C), the baked soybeans are cooled to 35°C or less.

14. The process according to claim 1, wherein, in step (4), the enzyme-inactivation treatment is an enzyme-inactivation treatment by steam, which is carried out at a temperature of 40°C to 65°C for a period of 110 to 200 seconds.

15. The process according to claim 14, wherein, in step (4), the enzyme-inactivation treatment is carried out at a steam pressure of 0.05 to 0.25 MPa.

16. The process according to claim 1, wherein, in step (6-1), the enzyme-inactivation treatment is an enzyme-inactivation treatment by steam, which is carried out at a temperature of 100°C to 150°C for a period of 40 to 180 seconds.

17. The process according to claim 16, wherein, in step (6-1), the enzyme-inactivation treatment is carried out at a steam pressure of 0.3 to 3 MPa.

18. The process according to any one of claims 1 to 17, characterized by one or more of the following a to i:

- a. in step (2), the pulp-milling treatment is carried out at a temperature of 35°C to 65°C;
- b. in step (3), the pulp-milling treatment is carried out at a temperature of 35°C to 65°C;
- c. in step (1), the soaking is carried out at a temperature of 35°C to 65°C;
- d. in step (1), the soaking is carried out for a period of 1 to 30 minutes;
- e. in step (1), the weight ratio of soybean to the liquid enzymic preparation is 1: (1 to 10);
- f. in step (2), the particulate matter in the first milled material has a particle size of not less than 100 mesh;
- g. in step (3), the particulate matter in the second milled material has a particle size of 230 to 180 mesh;
- h. in step (5), the solid-liquid separation is carried out by means of a slurry separator;
- i. the process further comprises a step (8): subjecting the first product or second product to a sterilization treatment.

19. The process according to claim 18, wherein, in step (8), the first product or second product is subjected to a steam-infusion sterilization treatment.

20. The process according to claim 18, wherein, in step (8), the sterilization treatment is carried out at a temperature of 110°C to 150°C.

21. The process according to claim 18, wherein, in step (8), the sterilization treatment is carried out for a period of 2 seconds to 1 minute.

22. A soymilk, prepared by the process according to any one of claims 1 to 21.

23. The soymilk according to claim 22, having a protein content of not less than 6% by weight.

24. The soymilk according to claim 22, having a sediment content of not more than 5% by weight.

25. The soymilk according to claim 22, having a shelf life of not less than half a year.

26. A soymilk beverage, comprising soymilk according to any one of claims 22 to 25, optionally fat-providing sources, optionally carbohydrate-providing sources, optionally food

additives, and optionally water.

27. Use of the soymilk according to any one of claims 22 to 25 in the preparation of soymilk beverages.