

Description

Title of Invention: LIQUID FERMENTED MILK AND METHOD FOR PRODUCING SAME

Technical Field

[0001] The present invention relates to a liquid fermented milk and a method of producing the liquid fermented milk.

Background Art

[0002] In production of fermented milk, there is known a technology involving using a lactic acid bacterium and yeast in combination with a view to, for example, imparting a peculiar taste and flavor originating from the yeast.

For example, in Patent Literature 1, there is a disclosure of a production method for a kefir-like dairy product, including the steps of: partially decomposing lactose contained in animal milk with lactase; carrying out lactic acid fermentation with a lactic acid bacterium that does not accumulate galactose in a medium; and subjecting fermented milk obtained by the lactic acid fermentation to alcohol fermentation with a lactose-fermenting yeast, in which the alcohol fermentation is carried out until the lactose in the medium substantially disappears.

In Patent Literature 2, as Examples 5-1 to 5-3, there are disclosures that: a fermented milk was obtained by adding powdered skim milk to deionized water, pasteurizing the mixture, and then

inoculating a lactic acid bacterial strain, followed by fermentation at 37°C for 24 hours; and a fermentation product was obtained by adding HF corn syrup and fructose to the fermented milk, and then inoculating a yeast starter, followed by fermentation at various fermentation temperatures for various fermentation times. In addition, in Patent Literature 2, there is a disclosure that when the fermentation product obtained in Examples described above was subjected to sensory evaluation, a kumis-like taste and flavor with suppressed sweetness, and a peculiar aroma with a yogurt odor and a fruit odor matched were obtained.

[0003] Meanwhile, a method involving a combination of static fermentation and stirring fermentation is known as a fermentation method.

For example, in Example 1 of Patent Literature 3, there is a disclosure that a lactic acid bacterium and yeast fermented whey solution was obtained by: adding a powdered skim milk culture solution of a lactic acid bacterium starter to a powdered whey solution, followed by static fermentation; then adding a glucose solution and a yeast extract solution to the obtained lactic acid bacterium fermentation liquid; subsequently adding a culture solution of a yeast starter thereto; and carrying out aeration stirring culture at 200 rpm at 30°C for 20 hours while blowing sterile air.

Citation List

Patent Literature

[0004] [Patent Literature 1] JP 10-56961 A

[Patent Literature 2] JP 3929630 B2

[Patent Literature 3] JP 07-75521 A

Summary of the Invention

Problems to be Solved by the Invention

[0005] In the production of liquid fermented milk, in general, the liquid fermented milk is obtained by: adding a lactic acid bacterium to raw materials for fermented milk (e.g., powdered skim milk or raw milk), followed by static fermentation, to form curds as a lactic acid fermentation product; and then finely crushing the curds.

The inventors of the present invention have made studies on the combined use of a lactic acid bacterium and yeast in order to impart a rich aroma and the like in the development of a liquid fermented milk.

However, it has been found that in the case of simultaneously adding a lactic acid bacterium and yeast to raw materials for fermented milk, followed by static fermentation, carbon dioxide produced by the yeast causes the floating of solid matter, which makes it impossible to carry out the subsequent treatment such as homogenization treatment or pasteurization treatment.

In addition, it has been found that in the case of adding a lactic acid bacterium to raw materials for fermented milk, followed by static fermentation, to form curds, and then mixing a liquid

product obtained by finely crushing the curds, and yeast, followed by static fermentation, carbon dioxide produced by the yeast causes the floating of solid matter, which makes it impossible to carry out the subsequent treatment such as homogenization treatment or pasteurization treatment.

In view of the foregoing, an object of the present invention is to provide a liquid fermented milk that has a rich aroma and the like originating from yeast fermentation, and is satisfactory in external appearance and mouth feel, through the use of a lactic acid bacterium and yeast, and a method of producing the liquid fermented milk.

Means for Solving the Problems

[0006] The inventors of the present invention have made extensive studies in order to achieve the above-mentioned object. As a result, the inventors have found that by adding a lactic acid bacterium to raw materials for fermented milk, followed by static fermentation, and then adding yeast, followed by stirring fermentation, a liquid fermented milk that has a rich aroma and the like originating from yeast fermentation, is free of coarse particles (which are visually observed after the end of the stirring fermentation), does not cause the floating of solids, and is satisfactory in external appearance and mouth feel can be obtained. Thus, the present invention has been completed.

[0007] That is, the present invention provides the following

items [1] to [9].

[1] A method of producing a liquid fermented milk, including: (A) a static fermentation step of adding a lactic acid bacterium to raw materials for fermented milk, followed by static fermentation, to yield a lactic acid fermentation product; and (B) a stirring fermentation step of adding yeast to the lactic acid fermentation product, followed by stirring fermentation, to yield a liquid fermented milk.

[2] The method of producing a liquid fermented milk according to the above-mentioned item [1], in which the static fermentation in the step (A) is carried out for from 3 to 45 hours, and the stirring fermentation in the step (B) is carried out for from 20 to 65 hours.

[3] The method of producing a liquid fermented milk according to the above-mentioned item [1] or [2], in which the static fermentation in the step (A) is carried out at a temperature of from 20 to 44°C, and the stirring fermentation in the step (B) is carried out at a temperature of from 20 to 44°C.

[4] The method of producing a liquid fermented milk according to any one of the above-mentioned items [1] to [3], in which no material other than yeast starter is added in the period from the beginning time of the static fermentation in the step (A) to the ending time of the stirring fermentation in the step (B).

[5] The method of producing a liquid fermented milk according to any one of the above-mentioned items [1] to [4], in which the raw materials for fermented milk include one or more kinds selected

from the group consisting of powdered skim milk, skim milk, raw milk, and a milk protein concentrate.

[6] The method of producing a liquid fermented milk according to any one of the above-mentioned items [1] to [5], further including (C) a homogenization step of subjecting the fermented milk to homogenization treatment, after the step (B).

[7] A liquid fermented milk, which is produced by the method of producing a liquid fermented milk according to the above-mentioned item [6].

[8] The liquid fermented milk according to the above-mentioned item [7], in which the median diameter of the particles that form the solids of the liquid fermented milk is 30 μm or less.

[9] A beverage that includes the liquid fermented milk according to the above-mentioned item [7] or [8], in which the median diameter of the particles that form the solids of the beverage is 2.5 μm or less.

Advantageous Effects of the Invention

[0008] According to the method of producing a liquid fermented milk of the present invention, a liquid fermented milk, that does not cause the floating of solids (which is observed in the case of carrying out only the static fermentation), or the coarsening of particles of solids (which is observed in the case of carrying out only the stirring culture), and has an external appearance as a homogeneous liquid product and satisfactory mouth feel, can be

obtained, because static fermentation is conducted after the addition of a lactic acid bacterium, and then stirring fermentation is conducted after the addition of yeast.

In addition, according to the method of producing a liquid fermented milk of the present invention, a liquid fermented milk, that has sourness originating from lactic acid which is a fermentation product of a lactic acid bacterium, and has a rich aroma, taste and flavor remaining behind, and slight alcohol aroma originating from a fermentation product of yeast, can be obtained, because yeast is used in addition to a lactic acid bacterium. It should be noted that the liquid fermented milk of the present invention has an alcohol content of less than 0.5 wt%, and hence can be served for drinking as a non-alcohol beverage.

The liquid fermented milk of the present invention may be served for drinking alone, or may be served for drinking after being mixed with other materials such as sugar, water or the like.

For example, a beverage having an external appearance as a homogeneous liquid product, satisfactory mouth feel, and palatability can be obtained by: subjecting the liquid fermented milk obtained in the present invention to homogenization treatment; mixing the liquid fermented milk obtained by the homogenization treatment with other materials (e.g., water, sugar or the like) to obtain a mixture; and subjecting the mixture to homogenization treatment. The beverage does not cause the generation of a precipitate (i.e. solids) at the bottom portion or the like of a

container for storing the beverage, and thus has a high commercial value.

Detailed Description of the Preferred Embodiments

[0009] A method of producing a liquid fermented milk of the present invention includes: (A) a static fermentation step of adding a lactic acid bacterium to raw materials for fermented milk, followed by static fermentation, to yield a lactic acid fermentation product; and (B) a stirring fermentation step of adding yeast to the lactic acid fermentation product obtained in the step (A), followed by stirring fermentation, to yield a liquid fermented milk.

In addition, the method of producing a liquid fermented milk of the present invention may include (C) a homogenization step of subjecting the liquid fermented milk obtained in the step (B) to homogenization treatment to yield a liquid fermented milk that has been subjected to the homogenization treatment.

Each of the steps is described below in detail.

[0010] [Step (A); static fermentation step]

The step (A) is a step of adding a lactic acid bacterium to raw materials for fermented milk, followed by static fermentation, to yield a lactic acid fermentation product.

The raw materials for fermented milk have only to yield a liquid product containing 5 wt% or more, preferably 8 wt% or more of solids-not-fat at the ending time of the stirring fermentation in the step (B).

As a main raw material for fermented milk, any one of various milks such as animal milk (e.g., cow milk, sheep milk, goat milk, or buffalo milk) or soybean milk, and a processed product thereof may be used without any particular limitation. For example, powdered skim milk, skim milk, raw milk, a milk protein concentrate, or the like can be used. Also, powdered whey, a whey protein concentrate, or the like, which is produced using whey as a raw material, can be used. As the main raw material for fermented milk, one kind of the materials described above may be used alone, or two or more kinds thereof may be used in combination.

As an auxiliary raw material for fermented milk, any one of known foods and food additives may be used without any particular limitation as long as the fermentation time is not extended to a great extent. Examples thereof include glucose and a yeast extract, which are used in Examples to be described later.

The main raw material for fermented milk as used herein refers to a milk-derived raw material. The auxiliary raw material for fermented milk refers to a raw material other than the milk-derived raw material, and excludes a lactic acid bacterium and yeast.

The ratio of the main raw material in the total amount of the raw materials for fermented milk is not particularly limited.

Water may be added to the raw materials for fermented milk as necessary. For example, when powdered skim milk is used alone as the main raw material for fermented milk, it is preferred to add from 50 to 150 parts by weight of water with respect to 10 parts

by weight of powdered skim milk.

In the case of adding water, any of the following can be employed: the lactic acid bacterium is added to a mixture of the raw materials for fermented milk and water; water is added to a mixture of the raw materials for fermented milk and the lactic acid bacterium; or the raw materials for fermented milk, water, and the lactic acid bacterium are simultaneously mixed.

[0011] The lactic acid bacterium has only to contain viable lactic acid bacterial cells and is not particularly limited. In general, a liquid product obtained by culturing the lactic acid bacterium in the presence of a nutrient source is used.

Such a liquid product may be obtained, for example, by: culturing a mixed liquid containing a nutrient source such as powdered skim milk, water, and a lactic acid bacterium at a predetermined temperature (e.g., from 35 to 40°C) for a predetermined time (e.g., from 10 to 20 hours) to yield a mother starter; mixing the obtained mother starter, water, and a nutrient source such as powdered skim milk to obtain a mixed liquid; and then further culturing the mixed liquid at a predetermined temperature (e.g., from 35 to 40°C) for a predetermined time (e.g., from 10 to 20 hours).

The number of lactic acid bacterial cells in the lactic acid bacterium is not particularly limited, and is, for example, from 1×10^7 to 1×10^9 cfu/ml.

As the lactic acid bacterium, one kind or two or more kinds of lactic acid bacteria selected from general lactic acid bacteria

to be used in the production of fermented milk may be used. Examples of such lactic acid bacteria include a lactic acid bacterium belonging to the genus *Lactobacillus* and a lactic acid bacterium belonging to the genus *Streptococcus*.

Examples of the lactic acid bacterium belonging to the genus *Lactobacillus* include *Lactobacillus helveticus*, *Lactobacillus delbruekii* subsp. *bulgaricus*, and *Lactobacillus acidophilus*.

In the present invention, *Lactobacillus helveticus* causes an increase in acidity to a greater extent as compared to other lactic acid bacteria, and hence is preferred from the viewpoint that the growth of a contaminating microorganism can be prevented even in fermented milk requiring long-term fermentation. Commercial products of *Lactobacillus helveticus* are easily available.

An example of the lactic acid bacteria belonging to the genus *Streptococcus* is *Streptococcus thermophilus*.

[0012] The static fermentation as used herein refers to fermentation in a static state without stirring.

The time for the static fermentation (i.e. the static fermentation time) is preferably from 3 to 45 hours, more preferably from 5 to 45 hours, still more preferably from 8 to 45 hours, yet still more preferably from 10 to 40 hours, even yet still more preferably from 15 to 35 hours, and particularly preferably from 20 to 30 hours.

The temperature for the static fermentation (i.e. the static fermentation temperature) is preferably from 25 to 50°C, more

preferably from 30 to 45°C, still more preferably from 32 to 43°C, and particularly preferably from 35 to 40°C.

The static fermentation yields curds as a fermentation product. The curds are finely crushed to yield a liquid product in the step (B).

[0013] [Step (B); stirring fermentation step]

The step (B) is a step of adding yeast to the lactic acid fermentation product obtained in the step (A), followed by stirring fermentation, to yield a liquid fermented milk.

The yeast has only to contain viable yeast cells and is not particularly limited. An example thereof is dry yeast.

Dry yeast is a yeast that is in a quiescent state through drying. Dry yeast may be used in a state of, for example, a liquid product obtained by being mixed with water.

Examples of the yeast used in the step (B) include *Saccharomyces cerevisiae*, *Saccharomyces pastrianus*, *Saccharomyces paradoxus*, and *Saccharomyces bayanus*.

In the present invention, *Saccharomyces cerevisiae* is preferred from the viewpoint of wide use, because a commercial product thereof is easily available. Examples of the commercial product of *Saccharomyces cerevisiae* include SAF Instant Dry Yeast Red (manufactured by Lesaffre) and Oriental Dry Yeast (manufactured by Oriental Yeast Co., Ltd.).

One kind of the yeasts may be used alone, or two or more kinds thereof may be used in combination.

The lactic acid fermentation product obtained in the step (A) is obtained by the static fermentation, and hence does not have a liquid form but has a solid curd form. In the step (B), the yeast may be added after the curds are finely crushed, or the yeast may be added to the curds before the curds are finely crushed by stirring.

[0014] The speed of the stirring is not particularly limited but is preferably from 10 to 150 rpm, and more preferably from 30 to 100 rpm from the viewpoints of: the crushing by shearing of the curds formed by the action of the lactic acid bacterium; the removal of carbon dioxide gas produced by the yeast; and the suppression of floating of solid matter.

The stirring may be any of continuous stirring and intermittent stirring. However, continuous stirring is preferred from the viewpoints of: the removal of carbon dioxide gas produced by the yeast; and the suppression of floating of solid matter.

The time for the stirring fermentation (i.e. the stirring fermentation time) is preferably from 20 to 50 hours, more preferably from 25 to 45 hours, still more preferably from 30 to 40 hours, and particularly preferably from 35 to 40 hours.

The temperature for the stirring fermentation (i.e. the stirring fermentation temperature) is preferably from 20 to 44°C, more preferably from 25 to 42°C, still more preferably from 30 to 40°C, and particularly preferably from 35 to 38°C.

The total of the static fermentation time in the step (A) and the stirring fermentation time in the step (B) is preferably from

40 to 85 hours, more preferably from 45 to 80 hours, still more preferably from 50 to 75 hours, yet still more preferably from 55 to 70 hours, and particularly preferably from 60 to 70 hours from the viewpoints of, for example: the taste and flavor of the liquid fermented milk; and practicability.

The lactic acid acidity (i.e. the acidity expressed as the percentage of lactic acid) of the liquid fermented milk may be adjusted by adding lactic acid or the like after the end of the stirring fermentation. The lactic acid acidity of the liquid fermented milk is preferably from 2.1 to 2.7% from the viewpoint of imparting appropriate sourness.

[0015] [Step (C); homogenization step]

The step (C) is a step of subjecting the liquid fermented milk obtained in the step (B) to homogenization treatment. The homogenization as used herein is not limited to homogenization treatment using a homogenizing machine (i.e. homogenizer) but also includes known shearing treatment by stirring or with a homomixer, an extruder, or the like.

In the case of, for example, using a homogenizing machine (i.e. homogenizer), the homogenization treatment is carried out by pressurization at a pressure of from 7 to 13 MPa as the first-stage homogenization treatment, followed by pressurization at a pressure of from 4 to 6 MPa as the second-stage homogenization treatment.

As the step (C), a combination of the first-stage and second-stage homogenization treatments may be carried out only once,

or a combination of the first-stage and second-stage homogenization treatments may be carried out twice or more. For example, after a combination of the first-stage and second-stage homogenization treatments has been carried out, heat pasteurization and cooling may be carried out, and then a combination of the first-stage and second-stage homogenization treatments may be further carried out.

The median diameter of particles constituting solids contained in the treated liquid fermented milk to be obtained in the step (C) is preferably 30 μm or less, more preferably 25 μm or less, still more preferably 20 μm or less, and particularly preferably 15 μm or less.

[0016] The liquid fermented milk obtained in the step (C) may be served for drinking alone, or may be served for drinking after being mixed with any other ingredients. Examples of other ingredients to be mixed with the liquid fermented milk include: a sweetener for imparting sweetness, such as sugar; an acidity regulator such as lactic acid; salt; a flavoring; and fruit juice.

The mixture of the liquid fermented milk and other ingredients may be subjected to homogenization treatment. The homogenization treatment in this case may be carried out in only one stage or in a plurality of stages (e.g., the first-stage and second-stage homogenization treatments used in combination). The homogenization treatment pressure is preferably from 10 to 20 MPa in total. In this case, the median diameter of particles constituting solids contained in the beverage (i.e. the mixture of the liquid fermented

milk and other ingredients) after the homogenization treatment is preferably 2.5 μm or less, more preferably 2.0 μm or less, still more preferably 1.5 μm or less, and particularly preferably 1.0 μm or less.

Examples

[0017] The present invention is described below by way of Examples. However, the present invention is by no means limited to Examples shown below.

[Example 1]

(1) Preparation of lactic acid bacterium starter

Powdered skim milk (manufactured by Meiji Co., Ltd.), powdered yeast extract (trade name: Yeast Extract T-154, manufactured by Oriental Yeast Co., Ltd.), a lactic acid bacterium (*Lactobacillus helveticus*, "FLAV 54 LYO 5D" manufactured by Danisco), and water were used to prepare a lactic acid bacterium starter. The lactic acid bacterium starter contained 10 wt% of the powdered skim milk, 90 wt% of water, 0.002 wt% of the yeast extract, and 3×10^8 cfu/ml of the lactic acid bacterium. The lactic acid bacterium starter had a lactic acid acidity of 1.6%.

(2) Preparation of yeast starter

Dry yeast (trade name: SAF Instant Dry Yeast Red, manufactured by Lesaffre) was added to sterile water having a temperature of 40°C to obtain a mixture, and the mixture was left to stand at rest for 20 minutes, which was used as a yeast starter in the preparation

of a liquid fermented milk to be described later.

[0018] (3) Preparation of liquid fermented milk

86.69 parts by weight of water heated to about 40°C, 10.76 parts by weight of powdered skim milk (manufactured by Meiji Co., Ltd.), 0.5 part by weight of glucose (trade name: Glufinal, manufactured by San-ei Sucrochemical Co., Ltd.), and 0.04 part by weight of powdered yeast extract (trade name: Yeast Extract T-154, manufactured by Oriental Yeast Co., Ltd.) were mixed. After that, the obtained mixed liquid was pasteurized at 75°C for 30 minutes and then cooled to 37°C. 2 parts by weight of the lactic acid bacterium starter described above were added to the mixed liquid after the cooling, and the obtained mixture was subjected to static fermentation at 37°C for 16 hours to form curds.

After the static fermentation, a stirring apparatus was run to crush curds, and at the same time, the yeast starter described above was added so that the blending amount was 0.01 part by weight in terms of the weight of dry yeast. The total amount of the above-mentioned ingredients was 100 parts by weight. The mixture was subjected to stirring fermentation at 37°C for 42 hours. The stirring was continuously carried out at 60 rpm.

After the end of the stirring fermentation, the obtained liquid fermented milk was found to have a lactic acid acidity of 2.4%, and hence lactic acid was added to adjust the acidity to 2.5%.

Next, the liquid fermented milk was subjected to the first-stage homogenization treatment at 10 MPa and the second-stage

homogenization treatments at 5 MPa. The liquid fermented milk after the homogenization treatments was pasteurized at 75°C for 30 minutes and then cooled to 10°C or less.

The obtained liquid fermented milk had a total solid content of 11.6 wt%, a solids-not-fat content of 10.4 wt%, and a lactic acid acidity of 2.5%, and a pH of 3.3. In addition, the liquid fermented milk was a homogeneous and milky liquid product free of floating solid matter and coarse particles and having sourness originating from lactic acid fermentation, a taste and flavor (i.e. mildness, a fruit-like aroma, and a rich aroma to be sensed afterwards) originating from yeast fermentation, and a slight alcohol aroma. The liquid fermented milk had no abnormal taste, abnormal odor, or foreign matter.

[0019] (4) Preparation of beverage

After having been subjected to homogenization treatment with a homogenizing machine (i.e. homomixer) at a pressure of 15 MPa in total, the liquid fermented milk obtained in the above-mentioned section (3) was heated at 85°C for 2 minutes, and then cooled to 10°C or less. The median diameter of particles constituting solids in the liquid fermented milk after the homogenization treatments was 14.05 μm .

Meanwhile, 0.2 part by weight of a soybean polysaccharide (trade name: SM900, manufactured by San-Ei Gen F.F.I., Inc.) was added to 82.02 parts by weight of water heated to 40°C to yield an aqueous solution. After that, the aqueous solution was cooled

to 10°C or less. To the aqueous solution were added 10.112 parts by weight of sugar, 0.063 part by weight of lactic acid (trade name: 50% Lactic Acid, manufactured by Daiichi Fine Chemical Co., Ltd.), 0.004 part by weight of salt, and 7.6 parts by weight of the liquid fermented milk treated with the homomixer described above to yield a mixed liquid. The total amount of the above-mentioned ingredients was 100 parts by weight. After having been heated to 60°C, the mixed liquid was homogenized with a homogenizing machine at a pressure of 15 MPa in total, and then cooled to 10°C or less. The mixed liquid after the cooling was heated at 110°C for 1 minute using an autoclave to yield a beverage.

The median diameter of particles constituting solids in the beverage was measured to be 1.0 µm. In addition, the simulated beverage was a milky and homogeneous liquid product having no abnormality in external appearance due to floating of solids or coarse particles.

[0020] [Example 2]

An experiment was carried out in the same manner as in Example 1 except that: the static fermentation time was set to 24 hours; and the stirring fermentation time was set to 40 hours.

As a result, the liquid fermented milk before the homogenization treatments was a homogeneous and milky liquid product free of floating solid matter and coarse particles and having sourness originating from lactic acid fermentation and the like, just like in Example 1. The liquid fermented milk had no abnormal taste,

abnormal odor, or foreign matter.

The median diameter of particles constituting solids in the liquid fermented milk after the homogenization treatments was 10 μm .

The median diameter of particles in the obtained beverage was 0.8 μm . The beverage was a milky and homogeneous liquid product having no precipitate on the bottom of a container for storing the simulated beverage.

[Example 3]

An experiment was carried out in the same manner as in Example 1 except that: the static fermentation time was set to 5 hours; and the stirring fermentation time was set to 59 hours.

As a result, the liquid fermented milk before the homogenization treatments was a milky liquid product free of floating solid matter and having sourness and the like originating from lactic acid fermentation, though the particles have a slightly large particle size, and a precipitate of coarse particles was observed when the liquid fermented milk were left to stand at rest for a long time. The liquid fermented milk had no abnormal taste, abnormal odor, or foreign matter.

The median diameter of particles in the obtained simulated beverage was 2.1 μm . A precipitate was slightly observed at the bottom portion and the like of a container for storing the beverage.

[0021] [Comparative Example 1]

An experiment was carried out in the same manner as in Example

1 except that: the lactic acid bacterium starter and the yeast starter were simultaneously added; the static fermentation time was set to 64 hours; and the stirring fermentation was not carried out.

As a result, the liquid fermented milk was poor in external appearance owing to the drying and hardening of solids floating on a liquid surface at the end of fermentation. Therefore, the solids were crushed by manual work before the homogenization treatment was carried out.

In addition, the median diameter of particles in the obtained beverage was 3.1 μm . A larger amount of a precipitate than that of Example 3 was observed at the bottom portion and the like of a container for storing the beverage.

[Comparative Example 2]

An experiment was carried out in the same manner as in Example 1 except that: the lactic acid bacterium starter and the yeast starter were simultaneously added; the time for the stirring fermentation was set to 64 hours; and the static fermentation was not carried out.

As a result, at the end of the fermentation of the liquid fermented milk, the floating of solids onto a liquid surface was not observed, whereas an abnormality in external appearance due to the precipitation of coarse particles was observed. The liquid fermented milk including the precipitated coarse particles was subjected to the subsequent treatment.

The median diameter of particles in the obtained beverage was

4.6 μm . A larger amount of a precipitate than that of Comparative Example 1 was observed on the bottom of a container for storing the beverage.

[Comparative Example 3]

An experiment was carried out in the same manner as in Example 1 except that: the lactic acid bacterium starter and the yeast starter were simultaneously added; the static fermentation time was set to 24 hours; and the stirring fermentation time was set to 40 hours.

As a result, the liquid fermented milk was poor in external appearance owing to the drying and hardening of solids floating on a liquid surface at the end of fermentation. Therefore, the solids were crushed by manual work before the homogenization treatment was carried out.

The median diameter of particles in the obtained simulated beverage was 2.0 μm . A precipitate was slightly observed at the the bottom portion and the like of a container for storing the beverage.

Table 1 shows the results. In Table 1, regarding comprehensive evaluation, Symbol "◎" represents "very satisfactory (i.e. excellent)", Symbol "o" represents "satisfactory (i.e. good)", and Symbol "x" represents "poor".

[0022]

[Table 1]

	Experimental conditions				Experimental results				
	Addition timing of lactic acid bacterium and yeast	Time for static fermentation (hr)	Time for stirring fermentation (hr)	Total time for fermentation (hr)	Presence or absence of floating of solids in liquid fermented milk	Presence or absence of coarse particles in liquid fermented milk	Median diameter of simulated beverage (μm)	Presence or absence of precipitation on bottom of container in simulated beverage	Comprehensive evaluation
Example 1	Different	16	42	58	Absent	Absent	1.0	Absent	◎
Example 2	Different	24	40	64	Absent	Absent	0.8	Absent	◎
Example 3	Different	5	59	64	Absent	Absent	2.1	Slightly present	○
Comparative Example 1	Same	64	0	64	Present	Absent	3.1	Present	×
Comparative Example 2	Same	0	64	64	Absent	Present	4.6	Present	×
Comparative Example 3	Same	24	40	64	Present	Absent	2.0	Slightly present	×

[0023] Table 1 reveals that in the cases of adding the lactic acid bacterium starter, followed by the static fermentation, and then adding the yeast starter, followed by the stirring fermentation (Examples 1 to 3), coarse particles are not generated and the floating of solids does not occur.

On the other hand, in the case of carrying out only the static fermentation (Comparative Example 1), there was a problem such as the floating of solids. In the case of carrying out only the stirring fermentation (Comparative Example 2), an abnormality in external appearance due to the precipitation of coarse particles was observed, although the floating of solids was not observed. In the case of using the static fermentation and the stirring fermentation in combination, while simultaneously adding the lactic acid bacterium starter and the yeast starter (Comparative Example 3), there was a problem such as the floating of solids.

Claims

1. A method of producing a liquid fermented milk having an alcohol content of less than 0.5 wt%, comprising:

(A) a static fermentation step of adding a lactic acid bacterium to raw materials for fermented milk, followed by static fermentation, to yield a lactic acid fermentation product;

(B) a stirring fermentation step of adding yeast to the lactic acid fermentation product, followed by stirring fermentation, to yield a liquid fermented milk; and

(C) a homogenization step of subjecting the liquid fermented milk obtained in the step (B) to homogenization treatment to yield the liquid fermented milk having an alcohol content of less than 0.5 wt%,

wherein the raw materials for fermented milk comprise one or more kinds selected from the group consisting of powdered skim milk, skim milk, raw milk, and a milk protein concentrate; and

the static fermentation in the step (A) is carried out for from 3 to 45 hours, and the stirring fermentation in the step (B) is carried out for from 20 to 65 hours.

2. The method of producing a liquid fermented milk according to claim 1, wherein the static fermentation in the step (A) is carried out at a temperature of from 20 to 44°C, and the stirring fermentation in the step (B) is carried out at a temperature of from 20 to 44°C.

3. The method of producing a liquid fermented milk according

to claim 1 or 2, wherein no material other than yeast starter is added in the period from the beginning time of the static fermentation in the step (A) to the ending time of the stirring fermentation in the step (B).

4. A liquid fermented milk, which is produced by the method of producing a liquid fermented milk according to any one of claims 1 to 3.

5. The liquid fermented milk according to claim 4, wherein the median diameter of the particles that form the liquid fermented milk is 30 μm or less.

6. The beverage comprising the liquid fermented milk according to claim 4 or 5, wherein the median diameter of the particles that form the solids of the beverage is 2.5 μm or less.