

DESCRIPTION

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

Technical Field

[0001]

The present invention relates to a liquid fermented milk and a method for producing the same.

Background Art

[0002]

A liquid fermented milk is one in which a solid fermented milk or a paste fermented milk obtained by gelling a raw material milk through fermentation is liquefied by a mechanical shear force of a homogenizer or the like. Examples of the liquid fermented milk include those called drink yogurts (drinkable yogurts), lactic acid bacteria beverages, fermented milk beverages, acidic milk beverages, and the like.

[0003]

As characteristics of these liquid fermented milks, they have advantages that it is unnecessary to prepare eating utensils such as spoons at the time of actually taking them and thus the fermented milks (lactic acid bacteria) can be conveniently taken. That is, the liquid fermented milk can be said as, for example, one evolutionary form of fermented milks, which can effectively supply nutrient during a busy life and also can make health appeal.

[0004]

For the liquid fermented milk, particularly defined classification or the like does not exist but, in view of physical properties thereof, the liquid fermented milk can be classified into two types, i.e., a low viscosity type and a high viscosity type.

[0005]

The low viscosity type liquid fermented milk is characterized in that a solid fermented milk or a paste fermented milk is, for example, liquefied by a homogenization pressure of 100 kg/cm^2 to 150 kg/cm^2 to convert it to a form drinkable in a sense of taking a beverage in a low viscosity (Non-Patent Document 1). In the low viscosity type liquid

fermented milk, owing to the physical property of low viscosity, there is a case where, by adding a stabilizer such as an HM pectin to cause charge repulsion of particles of milk proteins themselves, separation and precipitation thereof are suppressed and thus quality thereof is stabilized (Patent Document 1). Incidentally, similarly to the HM pectin, as stabilizers having an action of causing charge repulsion of particles of milk proteins themselves, a soybean polysaccharide, carboxymethyl cellulose (CMC), and the like are known. Incidentally, the low viscosity type liquid fermented milk means one generally having a viscosity of about 5 to 50 mPa.s (measurement temperature: 10°C).

[0006]

Moreover, for the low viscosity type liquid fermented milk, owing to the physical property of a liquid, sourness derived from lactic acid formed through metabolism of lactic acid bacteria tends to be easily felt as compared with solid fermented milks (e.g., set type yogurts, hard yogurts, standing yogurts, and post-fermented yogurts) and paste fermented milks (e.g., soft yogurts and stirred yogurts). Particularly, when much lactic acid is formed through metabolism of lactic acid bacteria during storage under refrigeration, flavor (sourness) of the fermented milk is greatly changed within the freshness date.

[0007]

As technologies for suppressing the formation of lactic acid during the storage of the low viscosity type liquid fermented milks under refrigeration, there are known a method of enhancing dissolved oxygen concentration in a liquid fermented milk (Patent Document 2), a method of fermenting a raw material milk at a fermentation temperature higher than predetermined one (Patent Document 3), and a method of homogenizing a solid fermented milk or a paste fermented milk under a pressure higher than predetermined one to achieve liquefaction (Patent Document 4).

[0008]

The high viscosity type liquid fermented milk is characterized in that a solid fermented milk or a paste fermented milk is, for example, liquefied by a gentle mechanical shear force to convert it into a form drinkable in a sense of taking a highly viscous, rich, and thick beverage. In the high viscosity type liquid fermented milk, owing to the physical property of high viscosity, there is a case where separation and precipitation thereof are suppressed and quality thereof is stabilized without using a stabilizer such as the aforementioned HM pectin. Incidentally, the high viscosity type liquid fermented milk means one generally having a viscosity of about 100 to 1,000 mPa.s (measurement

temperature: 10°C).

Prior Art Documents

Patent Documents

[0009]

Patent Document 1: WO2008/044533

Patent Document 2: JP-A-2011-004711

Patent Document 3: WO2011/083776

Patent Document 4: Japanese Patent No. 4963747

Non-Patent Document

[0010]

Non-Patent Document 1: "Miruku Sogo Jiten (Comprehensive Encyclopedia of Milk)" edited by Kunio Yamauchi and Kenkichi Yokoyama, Asakura Publishing Co., Ltd., 1992, pp. 246-247

Summary of the Invention

Problems that the Invention is to Solve

[0011]

Conventional low viscosity type liquid fermented milks are produced by liquefying a solid fermented milk or a paste fermented milk with a mechanical shear force under operation conditions in which a load equal to or more than the load under the production conditions of milk beverages or the like is imparted. Thus, owing to the physical property of low viscosity, as compared with conventional high viscosity liquid fermented milks, good aftertaste (aftertaste sharpness) is enough, but rich feeling (richness) derived from milk components is felt weaker.

[0012]

Moreover, conventional high viscosity type liquid fermented milks are produced by liquefying a solid fermented milk or a paste fermented milk with a mechanical shear force under operation conditions milder than the production conditions of milk beverages or the like. Thus, owing to the physical property of high viscosity, as compared with the conventional low viscosity liquid fermented milks, rich feeling derived from milk components is felt stronger but good aftertaste is not enough.

[0013]

That is, in the conventional production method of the liquid fermented milks, it is considered to be difficult to commercially realize a liquid fermented milk having flavor and texture that achieve both of rich feeling and good aftertaste. On the other hand, unlike the conventional liquid fermented milk, when a liquid fermented milk having flavor and texture that achieve both of rich feeling and good aftertaste is commercially realized, an improvement in palatability can be expected.

[0014]

In the present invention, an object is to provide a liquid fermented milk (drink yogurt or the like) having flavor and texture that achieve both of rich feeling and good aftertaste (for which rich feeling and good aftertaste are simultaneously felt).

Means for Solving the Problems

[0015]

As a result of extensive studies for solving the above problems, the present inventors have found that a liquid fermented milk having flavor and texture that achieve both of rich feeling and good aftertaste can be provided when it is a liquid fermented milk having a predetermined viscosity and a predetermined average particle size. Thus, they have accomplished the present invention.

[0016]

In addition, they have found that a liquid fermented milk obtained by blending (adding) a cation-reactive stabilizer into a raw material milk, adding (inoculating) lactic acid bacteria thereto and performing fermentation until pH reaches 3 to 5, and subsequently conducting liquefaction so as to be a viscosity of 200 to 800 mPa.s (measurement temperature: 10°C) and an average particle size of 20 μm or less has flavor and texture that achieve both of rich feeling and good aftertaste.

Furthermore, when the liquid fermented milk is stored under refrigeration (10°C, 14 days), syneresis and precipitation have not been observed.

[0017]

Namely, the present invention is constituted by the following [1] to [13].

[1] A liquid fermented milk having a viscosity of 200 to 800 mPa.s (measurement temperature: 10°C) and an average particle size of 20 μm or less.

[2] The liquid fermented milk according to the above [1], which comprises a cation-reactive stabilizer.

[3] The liquid fermented milk according to the above [2], which comprises 0.05 to 0.5% by weight of the cation-reactive stabilizer.

[4] The liquid fermented milk according to the above [2] or [3], wherein the cation-reactive stabilizer is any one kind alone or a combination of two or more kinds of κ -carrageenan, ι -carrageenan, deacylation gellan gum, an alginate, and a low methoxyl pectin (LM pectin).

[5] The liquid fermented milk according to any one of the above [1] to [4], which comprises 7 to 12% by weight of nonfat milk solids (SNF).

[6] The liquid fermented milk according to any one of the above [1] to [5], wherein syneresis and precipitation are not observed after 14 days of storage at 10°C from the time immediately after production.

[7] The liquid fermented milk according to any one of the above [1] to [6], wherein the viscosity expressed as a unit of mPa.s (measurement temperature: 10°C) is 20 times or more the average particle size expressed as a unit of μm .

[8] The liquid fermented milk according to any one of the above [1] to [7], wherein, in case where a relationship between shear stress and a shear rate at arbitrary three or more measurement points in the range of 1 to 1,000 s^{-1} of the shear rate is expressed by a numerical expression: $P=\mu D^n$, the value of n is 0.49 or less, where P means shear stress [Pa], D means a shear rate [s^{-1}], μ means a non-Newtonian viscosity coefficient, and n means a non-Newtonian viscosity index.

[9] A method for producing a liquid fermented milk, comprising: blending a cation-reactive stabilizer into a raw material milk; adding (inoculating) lactic acid bacteria thereto and performing fermentation until pH reaches 3 to 5; and subsequently conducting liquefaction thereof so as to be a viscosity of 200 to 800 mPa.s (measurement temperature: 10°C) and an average particle size of 20 μm or less.

[10] The method for producing a liquid fermented milk according to the above [9], wherein 0.05 to 0.5% by weight of the cation-reactive stabilizer is blended.

[11] The method for producing a liquid fermented milk according to the above [9] or [10], wherein the cation-reactive stabilizer is any one kind alone or a combination of two or more kinds of κ -carrageenan, ι -carrageenan, deacylation gellan gum, an alginate, and a low methoxyl pectin (LM pectin).

[12] The method for producing a liquid fermented milk according to any one of the above [9] to [11], wherein the milk contains 7 to 12% by weight of nonfat milk solids

(SNF).

[13] The method for producing a liquid fermented milk according to any one of the above [8] to [12], wherein the liquefaction is conducted using a super mixer.

Advantage of the Invention

[0018]

According to the present invention, there can be provided a liquid fermented milk (drink yogurt or the like) having flavor and texture that achieve both of rich feeling and good aftertaste, owing that the viscosity is 200 to 800 mPa.s (measurement temperature: 10°C) and the average particle size is 20 μ m or less.

Brief Description of the Drawings

[0019]

[FIG. 1] FIG. 1 shows results of functional tests (two-item comparison) of liquid fermented milks (Inventive product C and Control product B).

Modes for Carrying Out the Invention

[0020]

<Liquid Fermented Milk>

The liquid fermented milk of the invention is characterized in that the viscosity is 200 to 800 mPa.s (measurement temperature: 10°C) and the average particle size is 20 μ m or less and has flavor and texture that achieve both of rich feeling and good aftertaste.

[0021]

<Viscosity>

The liquid fermented milk of the invention has a viscosity of 200 to 800 mPa.s (measurement temperature: 10°C). The viscosity of the liquid fermented milk of the invention is preferably 250 to 750 mPa.s (measurement temperature: 10°C), more preferably 250 to 700 mPa.s (measurement temperature: 10°C), further preferably 300 to 650 mPa.s (measurement temperature: 10°C), and particularly preferably 300 to 600 mPa.s (measurement temperature: 10°C). At this time, when the viscosity of the liquid fermented milk is 200 mPa.s (measurement temperature: 10°C) or more, the rich feeling is easily realized. When the viscosity of the liquid fermented milk exceeds 800 mPa.s (measurement temperature: 10°C), liquidness becomes weak and a paste nature tends to

increase. A method of controlling the viscosity of the liquid fermented milk of the invention to the above range will be mentioned later in the method for producing the liquid fermented milk of the invention.

[0022]

In the invention, the viscosity can be measured by a B-type viscometer (e.g., VISCO METER-TV-10, Toki Sangyo Co., Ltd.). Specifically, after a sample (analyte): 100 mL is filled into a milk bottle (volume: 110 mL) at 10°C, using spindle M2 (Toki Sangyo Co., Ltd.) as a rotor, measurement can be performed with rotating the rotor (60 rpm, 30 seconds). In the case where the viscosity is measured by a method other than the above method in which measurement is performed by a B-type viscometer, the range of viscosity of the invention (upper limit value, lower limit value, etc.) can be set with adjusting a difference with the value of viscosity measured by the B-type viscometer.

[0023]

<Average Particle Size>

The liquid fermented milk of the invention has an average particle size of 20 μm or less. The average particle size of the liquid fermented milk of the invention is preferably 1 to 20 μm , more preferably 2 to 18 μm , further preferably 4 to 18 μm , still further preferably 6 to 16 μm , and particularly preferably 8 to 16 μm . At this time, when the average particle size of the liquid fermented milk exceeds 20 μm , refreshing feeling becomes weak and smooth feeling on the tongue and the like also tend to decrease. A method of controlling the average particle size of the liquid fermented milk of the invention to the above range will be mentioned later in the method for producing the liquid fermented milk of the invention.

[0024]

In the invention, the average particle size can be measure by a laser diffraction particle size distribution analyzer (e.g., SALD-2000, Shimadzu Corporation) and can be calculated as a measured value of 50% particle size. Incidentally, the measured value of 50% particle size is a 50% particle size as an integrated value for the results of measuring particle size distribution of dispersants in the liquid fermented milk by a laser diffraction/scattering method and the 50% particle size as an integrated value is a particle size at which the number of particles obtained by accumulating the number of particles starting from particles having a small particle size reaches 50% of the total value of the number of particles. In the case where the average particle size is measured by a method

other than the above method in which measurement is performed by a laser diffraction particle size distribution analyzer, the range of average particle size of the invention (upper limit value, lower limit value, etc.) can be set with adjusting a difference with the value of the average particle size measured by the laser diffraction particle size distribution analyzer.

[0025]

<Cation-Reactive Stabilizer>

The liquid fermented milk of the invention has a predetermined viscosity and a predetermined average particle size and preferably contains a cation-reactive stabilizer. In the invention, the cation-reactive stabilizer is a generic term for a stabilizer that reacts with a cation to cause gelation. For example, calcium is present in milk components and the cation-reactive stabilizer reacts with calcium in the milk components to accelerate gelation.

[0026]

Incidentally, in the case of the low viscosity type liquid fermented milk, since a solid fermented milk or a paste fermented milk is crushed (pulverized) by a strong shear force, it is necessary to suppress or prevent gelation so that milk proteins and the like are not separated or precipitated through aggregation. Therefore, in the liquid fermented milk, as a common general technical knowledge, it is avoided to use a cation-reactive stabilizer that accelerates gelation. That is, heretofore, in the production of the low viscosity type liquid fermented milk, it is not supposed to use the cation-reactive stabilizer.

On the other hand, the high viscosity type liquid fermented milk has low refreshing feeling in aftertaste as compared with the low viscosity type liquid fermented milk. Even when the high viscosity type liquid fermented milk is produced, since a solid fermented milk or a paste fermented milk is liquefied by a mild mechanical shear force, it is hitherto not supposed to use the cation-reactive stabilizer. In the invention, surprisingly, in the high viscosity type liquid fermented milk, by incorporating the cation-reactive stabilizer that has been avoided in the production of the low viscosity type liquid fermented milk, the flavor and texture that achieve both of rich feeling and good aftertaste can be realized with a predetermined viscosity and a predetermined average particle size.

[0027]

That is, in the liquid fermented milk of the invention, by daringly adding the cation-reactive stabilizer to a raw material milk before sterilization and/or before fermentation of the raw material milk, the flavor and texture that achieve both of rich

feeling and good aftertaste can be realized with a predetermined viscosity and a predetermined average particle size. Namely, a liquid fermented milk having flavor and texture that achieve both of rich feeling and good aftertaste is produced by adding the cation-reactive stabilizer to the raw material milk and, after sterilization (under heating), adding lactic acid bacteria and performing fermentation until pH reaches 3 to 5 or adding the cation-reactive stabilizer after sterilization of the raw material milk (under heating) and also adding lactic acid bacteria and performing fermentation until pH reaches 3 to 5 to prepare a solid fermented milk and by liquefying (crushing) a curd of the solid fermented milk so as to be a viscosity of 200 to 800 mPa.s (measurement temperature: 10°C) and an average particle size of 20 μ m or less.

[0028]

In the invention, the amount of the cation-reactive stabilizer to be added to the raw material milk is not particularly limited as long as the advantages of the invention are obtained but specifically, relative to the whole of the liquid fermented milk, the amount is, for example, 0.05 to 0.5% by weight, preferably 0.06 to 0.45% by weight, more preferably 0.06 to 0.4% by weight, further preferably 0.07 to 0.35% by weight, and particularly preferably 0.07 to 0.3% by weight.

[0029]

Moreover, in the invention, the amount of the cation-reactive stabilizer to be added to the raw material milk is, relative to the whole of the raw material milk, for example, 0.05 to 0.5% by weight, preferably 0.06 to 0.45% by weight, more preferably 0.06 to 0.4% by weight, further preferably 0.07 to 0.35% by weight, and particularly preferably 0.07 to 0.3% by weight.

[0030]

In the invention, the kind of the cation-reactive stabilizer is not particularly limited as long as the advantages of the invention are obtained but specifically, there may be exemplified κ -carrageenan, ι -carrageenan, deacylation gellan gum, an alginate, and a low methoxyl pectin (LM pectin). Any one kind thereof may be used alone or two or more kinds thereof may be used in combination. Moreover, in the invention, as the cation-reactive stabilizer, a commercially available preparation can be also used. At this time, since a liquid fermented milk having flavor and texture that achieve both of richer feeling and better aftertaste can be produced, in addition, owing to easy handling and the like in the actual production process, it is preferable to use an LM pectin.

[0031]

Incidentally, in the invention, the kind of the cation-reactive stabilizer depends on the composition, concentration, and the like of the liquid fermented milk to be actually produced.

[0032]

For example, in the case where the cation-reactive stabilizer is the LM pectin, a DE value is specifically 16 to 46%, preferably 18 to 44%, more preferably 20 to 42%, and further preferably 22 to 40%. Moreover, the amide group content in the cation-reactive stabilizer is specifically 10 to 30%, preferably 13 to 28%, more preferably 16 to 27%, and further preferably 19 to 26%.

[0033]

In the invention, the pectin means polygalacturonic acid having an average molecular weight of 50,000 to 150,000Da. Galacturonic acid of the constituent sugar includes two kinds, i.e., a free type and a methyl ester type, and the ratio of galacturonic acid present as a methyl ester to the whole galacturonic acid is called degree of esterification (DE value). Depending on the DE value, the nature of the pectin varies. One having a DE value of 50% or more is called a high methoxy pectin (HM pectin) and one having a DE value of less than 50% is called a low methoxy pectin (LM pectin). Incidentally, for stabilization of conventional low viscosity type drink yogurts, the HM pectin was used (reference: "Miruku Sogo Jiten (Comprehensive Encyclopedia of Milk)", 3. Nyuseihin no Kako Gijutsu (Processing Technology of Milk Products), pp. 246-247).

[0034]

In the invention, an addition method of the cation-reactive stabilizer is not particularly limited as long as the advantages of the invention are obtained but it is exemplified to add the cation-reactive stabilizer to the raw material milk before sterilization and/or before fermentation of the raw material milk. That is, as an addition method of the cation-reactive stabilizer, it is sufficient that the stabilizer is dispersed/dissolved in the raw material milk. For example, there may be exemplified a method of dissolving the cation-reactive stabilizer by heating after dispersing it in water or the like and subsequently adding the resulting solution of the cation-reactive stabilizer to the raw material milk, a method of warming the raw material milk to a temperature at which the cation-reactive stabilizer can solve and dispersing/dissolving the cation-reactive stabilizer in the warmed raw material milk, a method of sterilizing the raw material milk and a solution of the

cation-reactive stabilizer separately and subsequently mixing them, and other methods. Incidentally, the other substances and components other than them are not particularly limited as long as the advantages of the invention are obtained, and can be arbitrarily added.

[0035]

<Raw Material Milk>

In the invention, the raw material milk is not particularly limited as long as it is a fluid (liquid or the like) before sterilization and/or before fermentation, containing raw milk, a milk product, soy milk, or the like without limiting to generally interpreted raw material milk. For example, there may be exemplified one obtained by dispersing/dissolving skim milk powder in raw milk, one obtained by dispersing/dissolving skim milk powder in water, and the like. That is, as the raw material milk, there may be exemplified animal milk such as cow's milk, processed products thereof (e.g., whole milk, skim milk, whole condensed milk, skim condensed milk, whole milk powder, skim milk powder, condensed milk, whey, cream, etc.), plant milk such as soy milk, and fluids containing a processed product thereof, and the like. Moreover, in the invention, for the raw material milk, the composition (milk fats, milk proteins, lactose, ash, etc.) can be appropriately adjusted. For example, in the liquid fermented milk, for stressing milk flavor, rich feeling, and the like, concentration of milk fats, milk proteins, and the like may be increased by adding cream, skim milk powder, and/or the like to the raw material milk.

[0036]

<Various Components>

In the invention, the concentration of the milk fats in the liquid fermented milk is not particularly limited as long as the advantages of the invention are obtained but specifically, the concentration is, relative to the whole of the liquid fermented milk, for example, 8% by weight or less, preferably 0.01 to 8% by weight, more preferably 0.01 to 7% by weight, further preferably 0.01 to 6% by weight, still further preferably 0.01 to 5% by weight, and particularly preferably 0.01 to 4% by weight. When the concentration of the milk fats relative to the whole of the liquid fermented milk falls within the above range, flavor as the liquid fermented milk is suitable.

[0037]

Moreover, in the invention, the concentration of the milk fats in the raw material milk is, relative to the whole of the raw material milk, for example, 8% by weight or less,

preferably 0.01 to 8% by weight, more preferably 0.01 to 7% by weight, further preferably 0.01 to 6% by weight, still further preferably 0.01 to 5% by weight, and particularly preferably 0.01 to 4% by weight. When the concentration of the milk fats relative to the whole of the raw material milk falls within the above range, flavor as the liquid fermented milk is suitable.

[0038]

In the invention, the concentration of the milk proteins in the liquid fermented milk is not particularly limited as long as the advantages of the invention are obtained but specifically, the concentration is, relative to the whole of the liquid fermented milk, for example, 10% by weight or less, preferably 1 to 10% by weight, more preferably 1.5 to 9% by weight, further preferably 2 to 8% by weight, still further preferably 2.5 to 7% by weight, and particularly preferably 3 to 6% by weight. This is because, when the concentration of the milk proteins relative to the whole of the liquid fermented milk falls within the above range, flavor is good.

[0039]

Moreover, in the invention, the concentration of the milk proteins in the raw material milk is, relative to the whole of the raw material milk, for example, 10% by weight or less, preferably 1 to 10% by weight, more preferably 1.5 to 9% by weight, further preferably 2 to 8% by weight, still further preferably 2.5 to 7% by weight, and particularly preferably 3 to 6% by weight. This is because, when the concentration of the milk proteins relative to the whole of the raw material milk falls within the above range, flavor is good.

[0040]

In the invention, the concentration of the nonfat milk solids (SNF) in the liquid fermented milk is not particularly limited as long as the advantages of the invention are obtained but specifically, the concentration is, relative to the whole of the liquid fermented milk, for example, 18% by weight or less, preferably 1 to 18% by weight, more preferably 3 to 16% by weight, further preferably 5 to 14% by weight, still further preferably 7 to 12% by weight, and particularly preferably 8 to 10% by weight. This is because, when the concentration of the nonfat milk solids (SNF) relative to the whole of the liquid fermented milk falls within the above range, flavor is good.

[0041]

Moreover, in the invention, the concentration of the nonfat milk solids (SNF) in

the raw material milk is, relative to the whole of the raw material milk, for example, 18% by weight or less, preferably 1 to 18% by weight, more preferably 3 to 16% by weight, further preferably 5 to 14% by weight, still further preferably 7 to 12% by weight, and particularly preferably 8 to 10% by weight. This is because, when the concentration of the nonfat milk solids (SNF) relative to the whole of the raw material milk falls within the above range, flavor is good. Incidentally, the nonfat milk solids (SNF) mean components excluding milk fats among milk components.

[0042]

In the invention, as long as the advantages of the invention are obtained, known foods and/or food additives can be appropriately added to the components of the raw material milk. That is, as additive components for the raw material milk, for example, there may be exemplified sugar, a saccharide other than sugar, a highly sensitive sweetener, a flavoring agent, a thickener, a gelling agent, a mineral, a vitamin, a functional material, water, and the like.

[0043]

<Production Method>

The method for producing a liquid fermented milk of the invention is characterized by blending a cation-reactive stabilizer into a raw material milk, adding lactic acid bacteria to the resulting blend and performing fermentation until pH reaches 3 to 5, and subsequently liquefying (crushing) it so as to be a viscosity of 200 to 800 mPa.s (measurement temperature: 10°C) and an average particle size of 20 μ m or less. That is, the method for producing a liquid fermented milk of the invention is characterized by adding a cation-reactive stabilizer to a raw material milk and, after sterilization (under heating), adding lactic acid bacteria and performing fermentation until pH reaches 3 to 5 or adding a cation-reactive stabilizer after sterilization of the raw material milk (under heating) and also adding lactic acid bacteria and performing fermentation until pH reaches 3 to 5 to prepare a solid fermented milk and by liquefying (crushing) a curd of the solid fermented milk so as to be a viscosity of 200 to 800 mPa.s (measurement temperature: 10°C) and an average particle size of 20 μ m or less.

[0044]

Furthermore, the method for producing a liquid fermented milk of the invention is characterized by having a step of adding a cation-reactive stabilizer to a raw material milk, a step of sterilizing the raw material milk, a step of adding lactic acid bacteria to the raw

material milk, a step of fermenting the raw material milk until pH reaches 3 to 5 to prepare a curd of a fermented milk, a step of liquefying the curd of the fermented milk so as to be a viscosity of 200 to 800 mPa.s (measurement temperature: 10°C) and an average particle size of 20 µm or less, and a step of filling the fermented milk into a container. At this time, from the viewpoint of easiness of handling in the actual production process and the like, it is preferable to have a method (step) of sterilizing the raw material milk after the cation-reactive stabilizer is added thereto. The liquid fermented milk of the invention thus produced is characterized by the aforementioned contents and also is characterized in that syneresis and precipitation are not observed after 14 days of storage at 10°C from the time immediately after production.

Incidentally, in the invention, the fact that "syneresis is not observed" means that syneresis is substantially not observed and refers to the case where syneresis is not observed at all or, even if syneresis is observed, the amount is extremely small. The fact that "syneresis is not observed" can be confirmed by visual observation.

Moreover, in the invention, the fact that "precipitation is not observed" means that precipitation is substantially not observed and refers to the case where precipitation is not observed at all or, even if precipitation is observed, the amount is extremely small. The fact that "precipitation is not observed" can be confirmed by visual observation.

[0045]

In the invention, as a method and an equipment for sterilizing the raw material milk, it is sufficient to use a method and an equipment usually used in the food field. At this time, as methods for sterilizing the raw material milk, for example, there may be exemplified a low temperature maintaining sterilization method (LTLT, 60 to 70°C, 20 to 40 minutes, etc.), a high temperature maintaining sterilization method (HTLT, 80 to 90°C, 5 to 20 minutes, etc.), a high temperature short time sterilization method (HTST, 100 to 110°C, 1 to 3 minutes, etc.), a ultrahigh temperature instantaneous sterilization method (UHT, 120 to 150°C, 1 to 10 seconds, etc.), and the like.

[0046]

As the equipment for sterilizing the raw material milk, for example, there may be exemplified equipments such as indirect heating type sterilizers (plate type sterilizers, tube type sterilizers, etc.), direct heating type sterilizers (steam injection type sterilizers, steam infusion type sterilizers, etc.), electric heating type sterilizers, retort sterilizers, tanks fitted with stirring/temperature controlling functions, and tanks fitted with stirring/temperature

controlling/pressure reducing/homogenizing functions. Any one kind alone thereof may be used or two or more kinds thereof may be used in combination.

[0047]

In the invention, for the fermentation of the raw material milk, it is sufficient to use microorganisms generally used in the food field and, for example, there may be exemplified lactic acid bacteria, bifidobacteria, yeasts, and the like. In the invention, as lactic acid bacteria, bifidobacteria, yeasts, and the like, known ones can be appropriately used as long as the advantages of the invention are obtained. Specifically, in the case of lactic acid bacteria, there may be exemplified *Lactobacillus delbrueckii* subsp. *bulgaricus*, *Streptococcus thermophilus*, *Lactococcus lactis* subsp. *lactis*, *Lactococcus lactis* subsp. *cremoris*, *Lactobacillus casei*, and *Lactobacillus bifidus* which have been successfully used in the production of fermented milks, and preferred is a combination (mixture) of *Lactobacillus delbrueckii* subsp. *bulgaricus* and *Streptococcus thermophilus* which have been successfully used in the production of yogurts. Hereinafter, the fermentation of the raw material milk will be specifically described using lactic acid bacteria as an example but the microorganisms which can be used in the fermentation of the raw material milk are not limited to lactic acid bacteria in the invention.

[0048]

In the invention, conditions for fermenting the raw material milk are not particularly limited as long as the advantages of the invention are obtained but it is preferable to appropriately control fermentation temperature and/or fermentation time. At this time, in the invention, the fermentation temperature depends on the kind of the lactic acid bacteria to be actually used and the optimum temperature of the activity of the lactic acid bacteria, and the like but the temperature is, for example, 30 to 50°C, preferably 35 to 48°C, and more preferably 38 to 45°C. Specifically, for example, in the combination (mixture) of *Lactobacillus delbrueckii* subsp. *bulgaricus* and *Streptococcus thermophilus*, the fermentation temperature is, for example, 30 to 45°C, preferably 32 to 44°C, more preferably 34 to 44°C, further preferably 36 to 43°C, and particularly preferably 38 to 43°C. When the fermentation temperature falls within the above range, a liquid fermented milk having a good flavor can be formed within a proper fermentation time.

[0049]

Moreover, in the invention, the fermentation time depends on the kind of the lactic acid bacteria to be actually used, the amount of the lactic acid bacteria to be added, the

fermentation temperature, and the like but the time is, for example, 2 to 15 hours, preferably 2.5 to 10 hours, and more preferably 3 to 6 hours. Specifically, for example, in the combination (mixture) of *Lactobacillus delbrueckii* subsp. *bulgaricus* and *Streptococcus thermophilus*, the fermentation time is, for example, 1 to 20 hours, preferably 1.5 to 15 hours, more preferably 2 to 10 hours, further preferably 2.5 to 8 hours, and particularly preferably 3 to 6 hours. When the fermentation time falls within the above range, a liquid fermented milk having a good production suitability and a good flavor can be formed.

[0050]

On the other hand, in the invention, it is preferable to appropriately control lactic acid acidity and/or pH at the time of completion of the fermentation of the raw material milk. At this time, in the invention, the lactic acid acidity at the time of completion of the fermentation is, for example, 0.5 to 1.5%, preferably 0.55 to 1.4%, more preferably 0.6 to 1.3%, further preferably 0.65 to 1.2%, and particularly preferably 0.7 to 1.1%. This is because, when the lactic acid acidity at the time of completion of the fermentation falls within the above range, a fermented milk having a good flavor is obtained.

[0051]

Moreover, in the invention, the pH at the time of completion of the fermentation is, for example, 3 to 5, preferably 3.2 to 4.9, more preferably 3.4 to 4.8, further preferably 3.6 to 4.7, and particularly preferably 3.8 to 4.6. This is because, when the pH at the time of completion of the fermentation falls within the above range, a fermented milk having a good flavor is obtained.

[0052]

Incidentally, the lactic acid acidity at the time of completion of the fermentation of the raw material milk can be, for example, calculated according to the following procedure. That is, after a sample of a fermented milk: 9 g is diluted twice with water and an indicator of phenolphthalein is added thereto, neutralization titration is performed with an aqueous sodium hydroxide solution (0.1 N) and, judging a state that slight red color does not disappear within 30 seconds to be an end point, the acidity can be calculated from a titration amount at the end point as a lactic acid amount in the sample: 100 g. In addition, the pH is measured by a pH meter, for example.

[0053]

In the invention, conditions for liquefying (crushing) a curd of a solid fermented milk are not particularly limited as long as the advantages of the invention are obtained but

are preferably appropriately controlled so that the viscosity after liquefaction (viscosity of the liquid fermented milk) becomes a predetermined viscosity and the average particle size after liquefaction becomes a predetermined particle size. At this time, in the invention, the viscosity after liquefaction is 200 to 800 mPa.s (measurement temperature: 10°C) and is preferably 250 to 750 mPa.s (measurement temperature: 10°C), more preferably 250 to 700 mPa.s (measurement temperature: 10°C), further preferably 300 to 650 mPa.s (measurement temperature: 10°C), and particularly preferably 300 to 600 mPa.s (measurement temperature: 10°C). This is because, when the viscosity after liquefaction is controlled to the above range, a fermented milk having a good texture is obtained.

Furthermore, at this time, in the invention, the average particle size after liquefaction (average particle size of the liquid fermented milk) is 20 μm or less, and is preferably 1 to 20 μm , more preferably 2 to 18 μm , further preferably 4 to 18 μm , still further preferably 6 to 16 μm , and particularly preferably 8 to 16 μm . At this time, when the average particle size of the liquid fermented milk exceeds 20 μm , refreshing feeling becomes weak and smoothness on the tongue and the like also tend to decrease.

[0054]

In the invention, as a method and an equipment for liquefying a curd of a solid fermented milk, it is sufficient to use a method and an equipment that are usually used in the food field. At this time, as the method for liquefying the curd of the solid fermented milk, a mechanical shear force can be utilized, and there may be exemplified a method of liquefying it before cooling after (completion of) fermentation, a method of liquefying it after cooling after (completion of) fermentation, a method of liquefying it before cooling in the midway of fermentation, and the like.

[0055]

As the equipment for liquefying the curd of the solid fermented milk, for example, there may be exemplified a homogenizer (homogenizing machine), a homomixer, a homodisper, a super mixer, a mesh filter, an inline mixer, tanks fitted with stirring/temperature controlling functions, and tanks fitted with stirring/temperature controlling/pressure reducing/homogenizing functions. Any one kind alone thereof may be used or two or more kinds thereof may be used in combination.

[0056]

Incidentally, in the invention, conditions for liquefying the curd of the solid fermented milk to obtain a liquid fermented milk having a viscosity of 200 to 800 mPa.s

(measurement temperature: 10°C) and an average particle size of 20 μm or less depend on the flavor, texture, and the like of the liquid fermented milk to be actually produced. One skilled in the art of the invention can obtain a liquid fermented milk having a predetermined viscosity and a predetermined average particle size by using any of the aforementioned equipments for liquefying the curd of the solid fermented milk under suitable conditions depending on the flavor, texture, and the like of the liquid fermented milk to be produced. Specifically, for example, in the case of using a homogenizer, it is exemplified to control the pressure to 0 to 20 MPa, and the pressure is preferably 0.2 to 15 MPa, more preferably 0.4 to 10 MPa, further preferably 0.6 to 8 MPa, and particularly preferably 0.8 to 6 MPa. Incidentally, the super mixer is an apparatus that utilizes a shear force while utilizing cavitation that is a flow characteristic of a venturi tube, and an NRK multi mixer (Nichiraku Machinery Co., Ltd) is exemplified.

[0057]

Since the liquid fermented milk of the invention has flavor and texture that achieve both of rich feeling and good aftertaste, it has specific properties different from those of conventional liquid fermented milks. At this time, the properties of the liquid fermented milk of the invention are not particularly limited as long as the advantages of the invention are obtained. Specifically, as one index representing the properties of the liquid fermented milk, it is exemplified that the viscosity expressed as a unit of mPa.s is 20 times or more the average particle size expressed as a unit of μm , and the ratio is preferably 20 to 100 times, more preferably 20 to 80 times, further preferably 20 to 70 times, still further preferably 20 to 60 times, and particularly preferably 20 to 50 times.

[0058]

That is, in the liquid fermented milk of the invention, as compared with conventional liquid fermented milks, the ratio of the viscosity expressed as a unit of mPa.s to the average particle size expressed as a unit of μm is large. In the liquid fermented milk of the invention, while it has rich feeling owing to the high viscosity, it has good aftertaste owing to the small average particle size.

[0059]

Since the liquid fermented milk of the invention has flavor and texture that achieve both of rich feeling and good aftertaste, it has specific properties different from those of conventional liquid fermented milks. At this time, the properties of the liquid fermented milk of the invention are not particularly limited as long as the advantages of the invention

are obtained. Specifically, as one index representing the properties of the liquid fermented milk, it is exemplified that a non-Newtonian viscosity index (n) is 0.49 or less, and the index is preferably 0.1 to 0.49, more preferably 0.1 to 0.47, further preferably 0.1 to 0.45, still further preferably 0.1 to 0.43, and particularly preferably 0.1 to 0.4.

[0060]

Incidentally, the non-Newtonian viscosity index is represented by n in the mathematical expression of $P=\mu D^n$ (viscosity equation of shear fluidization properties). Here, P means shear stress [Pa], D means a shear rate [s^{-1}], μ means a non-Newtonian viscosity coefficient, n means a non-Newtonian viscosity index.

[0061]

In general, since viscosity is greatly lowered by a shear force in a liquid food having a small non-Newtonian viscosity index (n), viscosity is high and rich feeling is present at the time when the food is actually taken orally into the oral cavity but the viscosity becomes low and aftertaste is good when it is actually swallowed. That is, in the liquid fermented milk of the invention, as compared with conventional liquid fermented milks, the non-Newtonian viscosity index (n) is small. In the liquid fermented milk of the invention, while it has rich feeling owing to the high viscosity, it has good aftertaste owing to the small non-Newtonian viscosity index (n).

[0062]

In the invention, the non-Newtonian viscosity index (n) is measured by a dynamic viscoelasticity measuring apparatus (e.g., Physica MCR301, Anton-Paar) and can be calculated from a relationship between shear stress and the shear rate (measured results) at arbitrary three or more measuring points in the range of 1 to 1,000 s^{-1} of the shear rate. Specifically, after a sample (analyte) is filled into a predetermined container at 25°C, the index can be measured with setting GAP to 1 mm using a cone plate (diameter: 50 mm). In the case where the non-Newtonian viscosity index (n) is calculated by a method other than the above method in which the measurement is performed by the dynamic viscoelasticity measuring apparatus, the range (upper limit value, lower limit value, etc.) of the non-Newtonian viscosity index (n) of the invention can be set with adjusting a difference with the calculated values of the non-Newtonian viscosity index (n) measured by the dynamic viscoelasticity measuring apparatus. Incidentally, in the case where the non-Newtonian viscosity index (n) is 1, it means a Newtonian fluid.

Examples

[0063]

Hereinafter, the present invention will be described in detail with reference to Examples but the invention should not be construed as being limited to these Examples.

[0064]

[Example 1] Production of Inventive Product A

A skim milk powder (Meiji Co., Ltd.): 8.6 kg, sugar: 6.5 kg, an LM pectin (LM pectin having a DE value: 23 and an amide group content: 24, also referred to as "LM Pectin 01"): 0.1 kg were dispersed/dissolved in hot water (60°C): 84.8 kg to prepare a raw material milk (before sterilization) in a small-sized tank (fitted with stirring blades). Incidentally, solubility of the LM Pectin 01 in hot water was good. After the raw material milk containing the LM pectin after dispersion/dissolution was heated (60°C), it was sterilized (130°C, 2 seconds) by passing through a plate type sterilizer (VHX, Iwai Kikai Kogyo Co., Ltd.) and subsequently cooled (45°C) to prepare a raw material milk (after sterilization). After a lactic acid bacteria starter (a mixture of *Lactobacillus delbrueckii* subsp. *bulgaricus* and *Streptococcus thermophilus* separated from "Meiji Bulgaria Yogurt plain"): 2 kg was added to the raw material milk containing the LM pectin after sterilization, the whole was kept (43°C, 6 hours) in a small-sized tank (fitted with stirring blades) and fermented until lactic acid acidity reached 0.8% (pH 4.2) to prepare a solid fermented milk. After a curd of the solid fermented milk was crushed with the stirring blades to prepare a paste fermented milk, the paste fermented milk was crushed (pulverized) in a super mixer (NRK multi mixer, Nichiraku Machinery Co., Ltd., mohnopump: 50 Hz) and then cooled (10°C) to prepare a liquid fermented milk. Incidentally, nonfat milk solid content (SNF) of the liquid fermented milk was 8.2% by weight and fat content (FAT) was 0.1% by weight. Moreover, for the liquid fermented milk, when functional tests (rich feeling, aftertaste) were performed by six specialized panelists, the liquid fermented milk had flavor and texture that achieve both of rich feeling and good aftertaste. When the liquid fermented milk was stored under refrigeration (10°C, 14 days) immediately after production, syneresis and precipitation were not observed.

[0065]

[Example 2] Production of Inventive Product B

A skim milk powder (Meiji Co., Ltd.): 8.6 kg, sugar: 6.5 kg, an LM pectin (LM pectin having a DE value: 23 and an amide group content: 24, also referred to as "LM

Pectin 01"): 0.25 kg were dispersed/dissolved in hot water (60°C): 84.65 kg to prepare a raw material milk (before sterilization) in a small-sized tank (fitted with stirring blades). Incidentally, solubility of the LM Pectin 01 in hot water was good. After the raw material milk containing the LM pectin after dispersion/dissolution was heated (60°C), it was sterilized (130°C, 2 seconds) by passing through a plate type sterilizer (VHX, Iwai Kikai Kogyo Co., Ltd.) and subsequently cooled (45°C) to prepare a raw material milk (after sterilization). After a lactic acid bacteria starter (a mixture of *Lactobacillus delbrueckii* subsp. *bulgaricus* and *Streptococcus thermophilus* separated from "Meiji Bulgaria Yogurt plain"): 2 kg was added to the raw material milk containing the LM pectin after sterilization, the whole was kept (43°C, 6 hours) in a small-sized tank (fitted with stirring blades) and fermented until lactic acid acidity reached 0.8% (pH 4.2) to prepare a solid fermented milk. After a curd of the solid fermented milk was crushed with the stirring blades to prepare a paste fermented milk, the paste fermented milk was crushed (pulverized) in a super mixer (NRK multi mixer, Nichiraku Machinery Co., Ltd., mohnopump: 50 Hz) and then cooled (10°C) to prepare a liquid fermented milk. Incidentally, nonfat milk solid content (SNF) of the liquid fermented milk was 8.2% by weight and fat content (FAT) was 0.1% by weight. Moreover, for the liquid fermented milk, when functional tests (rich feeling, aftertaste) were performed by six specialized panelists, the liquid fermented milk had flavor and texture that achieve both of rich feeling and good aftertaste. When the liquid fermented milk was stored under refrigeration (10°C, 14 days) immediately after production, syneresis and precipitation were not observed.

[0066]

[Comparative Example 1] Production of Control Product A

A skim milk powder (Meiji Co., Ltd.): 8.6 kg and sugar: 6.5 kg were dispersed/dissolved in hot water (60°C): 84.9 kg to prepare a raw material milk (before sterilization) in a small-sized tank (fitted with stirring blades). After the raw material milk containing no LM pectin after dispersion/dissolution was heated (60°C), it was sterilized (130°C, 2 seconds) by passing through a plate type sterilizer (VHX, Iwai Kikai Kogyo Co., Ltd.) and subsequently cooled (45°C) to prepare a raw material milk (after sterilization). After a lactic acid bacteria starter (a mixture of *Lactobacillus delbrueckii* subsp. *bulgaricus* and *Streptococcus thermophilus* separated from "Meiji Bulgaria Yogurt plain"): 2 kg was added to the raw material milk containing no LM pectin after sterilization, the whole was kept (43°C, 6 hours) in a small-sized tank (fitted with stirring blades) and fermented until

lactic acid acidity reached 0.8% (pH 4.2) to prepare a solid fermented milk. After a curd of the solid fermented milk was crushed with the stirring blades to prepare a paste fermented milk, the paste fermented milk was crushed (pulverized) in a super mixer (NRK multi mixer, Nichiraku Machinery Co., Ltd., mohnopump: 50 Hz) and then cooled (10°C) to prepare a liquid fermented milk. Incidentally, nonfat milk solid content (SNF) of the liquid fermented milk was 8.2% by weight and fat content (FAT) was 0.1% by weight. Moreover, for the liquid fermented milk, when functional tests (rich feeling, aftertaste) were performed by six specialized panelists, the liquid fermented milk had good aftertaste equal to Examples 1 and 2 but did not have rich feeling as compared with Examples 1 and 2. When the liquid fermented milk was stored under refrigeration (10°C, 14 days) immediately after production, syneresis and precipitation were observed.

[0067]

[Test Example 1] Evaluation of Physical Properties of Inventive Product A (Example 1), Inventive Product B (Example 2), and Control Product A (Comparative Example 1)

The viscosity (measurement temperature: 10°C) and the average particle size of the liquid fermented milks (Inventive Product A, Inventive Product B, and Control Product A) of Example 1, Example 2, and Comparative Example 1 were measured. At this time, the viscosity was measured by a B-type viscometer (VISCO METER-TV-10, Toki Sangyo Co., Ltd.). Specifically, after a sample (analyte): 100 mL was filled into a milk bottle (volume: 110 mL) at 10°C, using spindle M2 (Toki Sangyo Co., Ltd.) as a rotor, measurement was performed with rotating the rotor (60 rpm, 30 seconds). Moreover, the average particle size was measured by a laser diffraction particle size distribution analyzer (SALD-2000, Shimadzu Corporation) and was calculated as a measured value of 50% particle size. Incidentally, the measured value of 50% particle size is a 50% particle size as an integrated value for the results of measuring particle size distribution of dispersants in the liquid fermented milk by a laser diffraction/scattering method and the 50% particle size as an integrated value is a particle size at which the number of particles obtained by accumulating the number of particles starting from particles having a small particle size reaches 50% of the total value of the number of particles.

[0068]

Based on the above, the results of measurement thereof are shown in Table 1 and the ratio of the viscosity (measurement temperature: 10°C) expressed as a unit of mPa.s to the average particle size expressed as a unit of μm was also calculated and was shown in

Table 1. At this time, the super mixer was used at the liquefaction of the fermented milk in Example 1, Example 2, and Comparative Example 1 and, as compared with Comparative Example 1 (Control Product A) in which no LM pectin was used, the ratio of the viscosity (mPa.s, measurement temperature: 10°C) to the average particle size (μm) was large in Example 1 (Inventive Product A) and Example 2 (Inventive Product B) in which the LM pectin was used. Moreover, while the viscosity (measurement temperature: 10°C) fallen within the range of 200 to 800 mPa.s in Example 1 (Inventive Product A) and Example 2 (Inventive Product B) in which the LM pectin was used, the viscosity (measurement temperature: 10°C) was less than 200 in Comparative Example 1 (Control Product A) in which no LM pectin was used.

[0069]

[Table 1]

Table 1

Evaluation item	Example 1	Example 2	Comparative Example 1
Viscosity (10°C) [mPa.s]	282	459	191
Average particle size [μm]	13	13	13
Viscosity/Average particle size	21.6	35.3	14.7

[0070]

[Test Example 2] Evaluation of Flavor/Physical Properties of Inventive Product A (Example 1), Inventive Product B (Example 2), Control Product A (Comparative Example 1), Commercially Available Product 1, and Commercially Available Product 2

For the liquid fermented milks (Inventive Product A, Inventive Product B, and Control Product A) of Example 1, Example 2, and Comparative Example 1 and commercially available liquid fermented milks, shear viscosity (Pa.s) was measured and a non-Newtonian viscosity coefficient μ was determined. As the commercially available liquid fermented milks, there were used "Yasuda Drinkable Yogurt" (Commercially Available Product 1, Yasuda Yogurt) and "Mainichi Honebuto, Ca for 1 day, Drinkable Yogurt" (Commercially Available Product 2, which were judged not to use the stabilizer from information indicated on goods, Megmilk Snow Brand Co., Ltd.) as targets. At this time, the shear viscosity while changing the shear rate was measured by a dynamic viscoelasticity measuring apparatus (Physica MCR301, Anton-Paar). Specifically, it was measured with setting GAP to 1 mm, the measurement temperature to 10°C, and the shear rate to 0.1 s^{-1} to 100 s^{-1} , using a cone plate (diameter: 50 mm, Anton-Paar).

[0071]

For the liquid fermented milks (Inventive Product A, Inventive Product B, and Control Product A) of Example 1, Example 2, and Comparative Example 1 and commercially available liquid fermented milks (Commercially Available Product 1, Commercially Available Product 2), functional tests (rich feeling, aftertaste) were performed by six specialized panelists, and the result of the tests were shown in Table 2. At this time, Example 1 (Inventive Product A) and Example 2 (Inventive Product B) had flavor and texture that achieve both of rich feeling and good aftertaste. On the other hand, Comparative Example 1 (Control Product A) and Commercially Available Product 2 had good aftertaste equal to Examples 1 and 2 but did not have rich feeling as compared with Examples 1 and 2. Commercially Available Product 1 had rich feeling equal to Examples 1 and 2 but did not have good aftertaste as compared with Examples 1 and 2. Incidentally, as compared with Comparative Example 1 (Control Product A) in which no LM pectin was used, Commercially Available Product 1, and Commercially Available Product 2, the non-Newtonian viscosity index (n) was low in Example 1 (Inventive Product A) and Example 2 (Inventive Product B) in which the LM pectin was used. That is, as compared with Comparative Example 1 (Control Product A), Commercially Available Product 1, and Commercially Available Product 2, in Example 1 (Inventive Product A) and Example 2 (Inventive Product B), it was found that the flavor and texture that achieve both of rich feeling and good aftertaste are realized, through a decrease in viscosity, by the shear force.

[0072]

[Table 2]

Table 2

Evaluation item	Example 1	Example 2	Comparative Example 1	Commercially available product 1	Commercially available product 2
Rich feeling	Yes	Yes	No	Yes	No
Good aftertaste	Yes	Yes	Yes	No	Yes
Non-Newtonian viscosity index	0.41	0.35	0.52	0.49	0.59

[0073]

[Example 3] Production of Inventive Product C

A skim milk powder (Meiji Co., Ltd.): 10.8 kg, sugar: 5 kg, and an LM pectin (LM pectin having a DE value: 23 and an amide group content: 24, also referred to as "LM Pectin 01"): 0.15 kg were dispersed/dissolved in hot water (60°C): 84.05 kg to prepare a raw material milk (before sterilization) in a small-sized tank (fitted with stirring blades).

Incidentally, solubility of the LM Pectin 01 in hot water was good (4 points, indices of the evaluation will be mentioned later; Table 3). After the raw material milk containing the LM pectin after dispersion/dissolution was heated (60°C), it was sterilized (130°C, 2 seconds) by passing through a plate type sterilizer (VHX, Iwai Kikai Kogyo Co., Ltd.) and subsequently cooled (45°C) to prepare a raw material milk. After a lactic acid bacteria starter (a mixture of *Lactobacillus delbrueckii* subsp. *bulgaricus* and *Streptococcus thermophilus* separated from "Meiji Bulgaria Yogurt plain"): 2 kg was added to the raw material milk containing the LM pectin after sterilization, the whole was kept (43°C, 6 hours) in a small-sized tank (fitted with stirring blades) and fermented until lactic acid acidity reached 1.0% (pH 4.2) to prepare a solid fermented milk. After a curd of the solid fermented milk was crushed with the stirring blades to prepare a paste fermented milk, the paste fermented milk was crushed (pulverized) in a super mixer (NRK multi mixer, Nichiraku Machinery Co., Ltd., mohnopump: 50 Hz) and then cooled (10°C) to prepare a liquid fermented milk. Incidentally, the viscosity of the liquid fermented milk was 565 mPa.s (measurement temperature: 10°C), nonfat milk solid content (SNF) was 10.25% by weight, and fat content (FAT) was 0.13% by weight. On the other hand, a glucose-fructose liquid sugar (Gun Ei Chemical Industry Co., Ltd.): 6 kg was dispersed/dissolved in hot water (50°C): 14 kg to prepare a sugar solution. Then, the sugar solution and the liquid fermented milk were mixed in a blending ratio of 2:8 to prepare a sugar-added liquid fermented milk. At this time, flavor and texture of the sugar-added liquid fermented milk were very good (5 points, indices of the evaluation will be mentioned later; Table 3). The viscosity of the sugar-added liquid fermented milk was 350 mPa.s (measurement temperature: 10°C), nonfat milk solid content (SNF) was 8.2% by weight, and fat content (FAT) was 0.1% by weight. Incidentally, when the sugar-added liquid fermented milk was stored under refrigeration (10°C, 14 days) immediately after production, syneresis and precipitation were not observed.

[0074]

[Comparative Example 2] Production of Control Product B

A skim milk powder (Meiji Co., Ltd.): 15 kg was dispersed/dissolved in hot water (60°C): 85 kg to prepare a raw milk (before sterilization) in a small-sized tank (fitted with stirring blades). After the raw material milk containing no LM pectin after dispersion/dissolution was sterilized (95°C, 10 minutes) in a tank fitted with a jacket and subsequently cooled (45°C) to prepare a raw material milk. After a lactic acid bacteria

starter (a mixture of *Lactobacillus delbrueckii* subsp. *bulgaricus* and *Streptococcus thermophilus* separated from "Meiji Bulgaria Yogurt plain"): 2 kg was added to the raw material milk containing no LM pectin after sterilization, the whole was kept (43°C, 6 hours) in a small-sized tank (fitted with stirring blades) and fermented until lactic acid acidity reached 1.2% (pH 4.3) to prepare a solid fermented milk. After a curd of the solid fermented milk was crushed with the stirring blades to prepare a paste fermented milk, the paste fermented milk was crushed (pulverized) in a homogenizer (Izumi Food Machinery Co., Ltd.) and then cooled (10°C) to prepare a liquid fermented milk. Incidentally, the viscosity of the liquid fermented milk was 80 mPa.s (measurement temperature: 10°C), nonfat milk solid content (SNF) was 14% by weight, and fat content (FAT) was 0.15% by weight. On the other hand, a glucose-fructose liquid sugar (Gun Ei Chemical Industry Co., Ltd.): 8 kg and HM Pectin: 0.25 kg were dispersed/dissolved in hot water (50°C): 31.75 kg to prepare a sugar solution. Then, the sugar solution and the liquid fermented milk were mixed in a blending ratio of 4:6 to prepare a sugar-added liquid fermented milk. The viscosity of the sugar-added liquid fermented milk was 20 mPa.s (measurement temperature: 10°C), nonfat milk solid content (SNF) was 8.4% by weight, and fat content (FAT) was 0.1% by weight. Incidentally, when the sugar-added liquid fermented milk was stored under refrigeration (10°C, 14 days) immediately after production, syneresis and precipitation were not observed.

[0075]

[Test Example 3] Evaluation of Flavor/Physical properties of Inventive Product C and Control Product B

For the liquid fermented milks (Inventive Product C and Control Product A) of Example 3 and Comparative Example 2, functional tests (two-item comparison) were performed by 200 married women of 30 to 60 years old among users of liquid fermented milk, and results of these tests were shown in FIG. 1. At this time, as compared with Comparative Example 2 (Control Product B) in which no LM pectin was used, in Example 3 (Inventive Product C) in which the LM pectin was used, deliciousness, preference in sourness, preference in sweetness, preference in balance between sourness and sweetness, preference in refreshing feeling, degree of rich feeling (richness), preference in rich feeling (richness), preference in aftertaste, flavor that does not cause satiation to drink, and degree of satisfaction were highly evaluated. That is, flavor and texture of Example 3 (Inventive Product C) were very good.

[0076]

[Example 4] Production of Inventive Product D

A liquid fermented milk and a sugar-added liquid fermented milk were prepared in the same manner as in Example 3 except that the LM pectin (LM pectin having a DE value: 23 and an amide group content: 24, also referred to as "LM Pectin 01") was changed to an LM pectin (LM pectin having a DE value: 33 to 39 and an amide group content: 13 to 17, also referred to as "LM Pectin 02") in Example 3. Incidentally, solubility of the LM Pectin 02 in hot water was good (4 points, indices of the evaluation will be mentioned later; Table 3). On the other hand, flavor and texture of the sugar-added liquid fermented milk were moderately good (3 points, indices of the evaluation will be mentioned later; Table 3). The viscosity of the sugar-added liquid fermented milk was 320 mPa.s (measurement temperature: 10°C), nonfat milk solid content (SNF) was 8.2% by weight, and fat content (FAT) was 0.1% by weight.

[0077]

[Example 5] Production of Inventive Product E

A liquid fermented milk and a sugar-added liquid fermented milk were prepared in the same manner as in Example 3 except that the LM pectin (LM pectin having a DE value: 23 and an amide group content: 24, also referred to as "LM Pectin 01") was changed to an LM pectin (LM pectin having a DE value: 26 to 32 and an amide group content: 17 to 22, also referred to as "LM Pectin 03") in Example 3. Incidentally, solubility of the LM Pectin 03 in hot water was good (4 points, indices of the evaluation will be mentioned later; Table 3). On the other hand, flavor and texture of the sugar-added liquid fermented milk were moderately good (3 points, indices of the evaluation will be mentioned later; Table 3). The viscosity of the sugar-added liquid fermented milk was 346 mPa.s (measurement temperature: 10°C), nonfat milk solid content (SNF) was 8.2% by weight, and fat content (FAT) was 0.1% by weight.

[0078]

Here, the solubility of an LM pectin in hot water was comprehensively evaluated according to the following criteria by adding the LM pectin to hot water (60°C), stirring and mixing them, and confirming the state visually.

5 points: when hot water is stirred for less than 15 seconds, lumps disappear and completely dissolve.

4 points: when hot water is stirred for 15 seconds or more and less than 30 seconds,

lumps disappear and completely dissolve.

3 points: when hot water is stirred for 30 seconds or more and less than 60 seconds, lumps disappear and completely dissolve.

2 points: even when hot water is stirred for 60 seconds or more, lumps do not disappear and do not completely dissolve.

1 point: even when hot water is stirred for 60 seconds or more, lumps remain and are difficult to dissolve.

[0079]

Moreover, the flavor of a sample (analyte) was comprehensively evaluated according to the following criteria by averaging results of six specialized panelist.

5 points: rich feeling is strong and sharpness of aftertaste and balance between sourness and sweetness are very good.

4 points: rich feeling is present and sharpness of aftertaste and balance between sourness and sweetness are good.

3 points: rich feeling is a middle level and sharpness of aftertaste and balance between sourness and sweetness are moderate.

2 points: rich feeling is a little weak and sharpness of aftertaste and balance between sourness and sweetness are slightly bad.

1 point: rich feeling is weak and sharpness of aftertaste and balance between sourness and sweetness are bad.

[0080]

[Test Example 4] Evaluation of Flavor/Physical properties of Inventive Product C (Example 3), Inventive Product D (Example 4), and Inventive Product E (Example 5)

For liquid fermented milks (Inventive Product C, Inventive Product D, and Inventive Product E) of Example 3, Example 4, and Example 5, flavor, physical properties, and the like were evaluated with changing the kind of LM pectin, and results of the evaluation, properties of various LM pectins, and the like were shown in Table 3. At this time, in any of Example 3 (Inventive Product C), Example 4 (Inventive Product D), and Example 5 (Inventive Product E), solubility of the LM pectins in hot water was good (4 points). On the other hand, flavor and texture of Example 3 (Inventive Product C) were very good (5 points) and flavor and texture of Example 4 (Inventive Product D) and Example 5 (Inventive Product E) were moderately good (3 points).

From the above results, in LM pectin, it was found that it is preferable that the DE

value is 16 to 46 and the amide group content is 10 to 30, it is more preferable that the DE value is 18 to 44 and the amide group content is 13 to 28, it is further preferable that the DE value is 20 to 42 and the amide group content is 16 to 27, and it is particularly preferable that the DE value is 22 to 40 and the amide group content is 19 to 26.

[0081]

[Table 3]

Table 3

Item	Properties of LM pectin		Comparison of flavor and physical properties		
	DE value	Amide group content	Solubility	Flavor	Viscosity [mPa.s]
Example 3 (LM Pectin 01)	23	24	4	5	350
Example 4 (LM Pectin 02)	33-39	13-17	4	3	320
Example 5 (LM Pectin 03)	26-32	17-22	4	3	346

[0082]

[Comparative Example 3] Production of Control Product C

A skim milk powder (Meiji Co., Ltd.): 10.8 kg and sugar: 5 kg were dispersed/dissolved in hot water (60°C): 84.2 kg to prepare a raw material milk (before sterilization) in a small-sized tank (fitted with stirring blades). After the raw material milk containing no LM pectin after dispersion/dissolution was heated (60°C), it was sterilized (130°C, 2 seconds) by passing through a plate type sterilizer (VHX, Iwai Kikai Kogyo Co., Ltd.) and subsequently cooled (45°C) to prepare a raw material milk (after sterilization). After a lactic acid bacteria starter (a mixture of *Lactobacillus delbrueckii* subsp. *bulgaricus* and *Streptococcus thermophilus* separated from "Meiji Bulgaria Yogurt plain"): 2 kg was added to the raw material milk containing no LM pectin after sterilization, the whole was kept (43°C, 6 hours) in a small-sized tank (fitted with stirring blades) and fermented until lactic acid acidity reached 1.0% (pH 4.2) to prepare a solid fermented milk. After a curd of the solid fermented milk was crushed with the stirring blades to prepare a paste fermented milk, the paste fermented milk was crushed (pulverized) in a super mixer (NRK multi mixer, Nichiraku Machinery Co., Ltd., mohnopump: 50 Hz) and then cooled (10°C) to prepare a liquid fermented milk. On the other hand, a glucose-fructose liquid sugar (Gun Ei Chemical Industry Co., Ltd.): 4 kg and an LM pectin (LM pectin having a DE value: 23 and an amide group content: 24, also referred to as "LM Pectin 01"): 0.1 kg were dispersed/dissolved in hot water (50°C): 15.9 kg to prepare a sugar solution (before sterilization). After the sugar solution containing the LM pectin after dispersion/dissolution was heated (60°C), it was sterilized (130°C, 2 seconds) by passing

through a plate type sterilizer (VHX, Iwai Kikai Kogyo Co., Ltd.) and subsequently cooled to prepare a sugar solution (after sterilization). When the sugar solution and the liquid fermented milk were mixed in a blending ratio of 2:8, the mixed liquid was gelled and a liquid fermented milk could not be prepared.

Industrial Applicability

[0083]

According to the present invention, it is possible to provide a liquid fermented milk (drink yogurt or the like) having flavor and texture that achieve both of rich feeling and good aftertaste (for which rich feeling and good aftertaste are simultaneously felt).

[0084]

While the invention has been described in detail and with reference to specific embodiments thereof, it will be apparent to one skilled in the art that various changes and modifications can be made therein without departing from the spirit and scope thereof. Incidentally, the present application is based on Japanese Patent Application No. 2014-221937 filed on October 30, 2014, and the contents are incorporated herein by reference.

CLAIMS

[Claim 1]

A liquid fermented milk having a viscosity of 200 to 800 mPa.s (measurement temperature: 10°C) and an average particle size of 20 μ m or less.

[Claim 2]

The liquid fermented milk according to claim 1, which comprises a cation-reactive stabilizer.

[Claim 3]

The liquid fermented milk according to claim 2, which comprises 0.05 to 0.5% by weight of the cation-reactive stabilizer.

[Claim 4]

The liquid fermented milk according to claim 2 or 3, wherein the cation-reactive stabilizer is one kind alone or a combination of two or more kinds of κ -carrageenan, ι -carrageenan, deacylation gellan gum, an alginate, and a low methoxyl pectin (LM pectin).

[Claim 5]

The liquid fermented milk according to any one of claims 1 to 4, wherein syneresis and precipitation are not observed after 14 days of storage at 10°C from the time immediately after production.

[Claim 6]

A method for producing a liquid fermented milk, comprising: blending a cation-reactive stabilizer into a raw material milk; adding lactic acid bacteria thereto and performing fermentation until the pH reaches 3 to 5; and subsequently conducting liquefaction thereof so as to be a viscosity of 200 to 800 mPa.s (measurement temperature: 10°C) and an average particle size of 20 μ m or less.

[Claim 7]

The method for producing a liquid fermented milk according to claim 6, wherein 0.05 to 0.5% by weight of the cation-reactive stabilizer is blended.

[Claim 8]

The method for producing a liquid fermented milk according to claim 6 or 7, wherein the cation-reactive stabilizer is one kind alone or a combination of two or more kinds of κ -carrageenan, ι -carrageenan, deacylation gellan gum, an alginate, and a low methoxyl pectin (LM pectin).

[Claim 9]

The method for producing a liquid fermented milk according to any one of claims 6 to 8, wherein the liquefaction is conducted using a super mixer.