

CHEESE AND PRODUCTION METHOD THEREFOR

TECHNICAL FIELD

[0001]

The present invention relates to a cheese-based food having good stretch ability even at low temperatures, and to a method for producing the cheese-based food.

BACKGROUND ART

[0002]

Natural cheese is prepared by curdling of raw milk with lactobacilli or rennet, removal of whey from the curdled mixture, and settling of the resultant curd. Processed cheese is prepared by addition of a molten salt to natural cheese, melting of the mixture under heating and stirring, and solidification of the melted mixture through cooling. In a process for preparing processed cheese, a food product having a cheese content of 50% or less is commonly specified in the art as a food mainly made from milk or milk products (hereinafter will be referred to as "cheese-based food").

[0003]

A known technique for imparting stretch ability to processed cheese involves thermal emulsification of raw material cheese having a low maturity index under low-speed agitation. Meanwhile, various methods have been disclosed for

controlling the properties of a cheese-based food by adding starch to processed cheese or a milk-based food; for example, a method for producing a food containing egg white or starch and having a hardness comparable to that of processed cheese (Patent Document 1); a method for producing a cheese food containing starch octenyl succinate and having excellent melting characteristics and stretch ability (Patent Document 2); a method for producing a cheese-based food having freezing resistance and frying resistance by adding a molten salt and oxidized starch to natural cheese (Patent Document 3); and a method for producing a cheese snack containing raw tapioca starch (Patent Document 4).

RELATED ART

[0004]

Patent Document 1: Japanese Patent No. 3391283

Patent Document 2: Japanese Patent No. 3887922

Patent Document 3: Japanese Patent No. 3108968

Patent Document 4: Japanese Patent No. 3373696

SUMMARY OF INVENTION

[0005]

The food disclosed in Patent Document 1 exhibits hardness comparable to that of processed cheese and has a cheese content as high as 80 wt%. The cheese food disclosed in Patent Document

2 has a cheese content of 83 wt% or more. The cheese-based food disclosed in Patent Document 3 exhibits freezing resistance and frying resistance and has a natural cheese content of 85 wt% or more. Each of these cheese-based foods has high hardness and thus exhibits no stretch ability in a cooled state. In the method disclosed in Patent Document 4, raw tapioca starch is used for providing a cheese snack with a good texture and improving the preservability of the cheese snack. Although the methods disclosed in Patent Documents 1 to 3 can impart stretch ability to a product such as a food, a cheese food, a cheese in a heated state, the product loses stretch ability in a cooled state due to hardening of the cheese contained in the product during cooling. Even if starch is added to a cheese-based food, the cheese-based food exhibits good stretch ability only in a heated state, and becomes hard after cooling. Meanwhile, a milk-based food having high oil and fat and water contents exhibits no stretch ability unlike cheese, and has a composition and a flavor different from those of processed cheese.

[0006]

An object of the present invention is to provide a cheese-based food exhibiting favorable stretch ability not only in a heated state but also at low temperatures, which has not yet been achieved by conventional techniques, and a method for producing the cheese-based food.

SOLUTION TO PROBLEM

[0007]

The present inventors have conducted extensive studies for solving the above-described problems. Consequently, the inventors have found that a cheese-based food containing 2.0 to 10.0 wt% processed tapioca starch and 16 to 24 wt% raw material cheese and having a pH of 4.0 or more, a water content of 53 to 63%, and a milk fat/milk protein ratio of 2.0 or less exhibits excellent stretch ability and flavor comparable to those of processed cheese in a wide temperature range, which has not yet been achieved by conventional techniques, and that the cheese-based food exhibits excellent stretch ability even after heating and cooling. The present invention has been accomplished on the basis of these findings.

[0008]

The present invention provides the following:

Aspect (1) A cheese-based food containing 2.0 to 10.0 wt% processed tapioca starch and 16 to 24 wt% raw material cheese and having a pH of 4.0 or more, a water content of 53 to 63%, and a milk fat/milk protein ratio of 2.0 or less.

Aspect (2) The cheese-based food according to Aspect (1), which exhibits a stretch of 10 cm or more determined through the following stretch ability test at 10°C:

stretch ability test: 40 g of the cheese-based food is collected in a cup, the cheese-based food is pulled up at a rate

of 2.5 cm/second, and the length of an elongated string of cheese at break is measured.

Aspect (3): A method for producing a cheese-based food, including: mixing raw material cheese with processed tapioca starch to prepare a raw material mixture; adjusting the pH, water content, and milk fat/milk protein ratio of the raw material mixture so that a cheese-based food has a pH of 4.0 or more, a water content of 53 to 63%, and a milk fat/milk protein ratio of 2.0 or less; thermally emulsifying the raw material mixture; and cooling the thermally emulsified raw material mixture.

EFFECTS OF INVENTION

[0009]

The present invention can provide a cheese-based food exhibiting favorable stretch ability even at low temperatures and having a cheese-like flavor, as well as a method for producing the cheese-based food.

DESCRIPTION OF EMBODIMENT

[0010]

The cheese-based food prepared according to the present invention has high oil and fat and water contents, and exhibits excellent stretch ability and flavor comparable to those of cheese in a wide temperature range; i.e., during both heating

and cooling states. As used herein, the term "cheese-based food" encompasses products specified in the Japanese Ministerial Ordinance on Milk and Milk products Concerning Compositional Standards, etc. (the Japanese Ministry of Health and Welfare Ordinance No. 52, December 27, 1951), products specified in the Fair Competition Code, and products common in the art, including milk-based foods.

[0011]

Any raw material cheese can be used in the present invention. Examples thereof include natural cheeses, such as Gouda cheese, mozzarella cheese, and cheddar cheese; processed cheeses; and cheese foods. These raw material cheeses may be used alone or in combination. The amount of the raw material cheese incorporated may be determined depending on the flavor required for a final cheese-based food. The cheese-based food of the present invention contains the raw material cheese in an amount of 16 to 24 wt%, preferably 18 to 22 wt%. A raw material cheese content below 16 wt% or exceeding 24 wt% may cause unsatisfactory stretch ability.

[0012]

The processed tapioca starch used in the present invention may be tapioca starch which has been subjected to any processing treatment, such as etherification, esterification, oxidation, or cross-linking treatment. The processed tapioca starch is preferably etherified starch, such as hydroxypropyl

starch, hydroxypropylated phosphate-crosslinked starch, sodium starch glycolate, carboxymethyl starch, or cationic starch, or esterified starch, such as hydroxypropylated phosphate-crosslinked starch, starch acetate, starch phosphate, or phosphate-crosslinked starch. Particularly preferred are hydroxypropyl starch, hydroxypropylated phosphate-crosslinked starch, and oxidized starch. The cheese-based food of the present invention contains the processed tapioca starch in an amount of 2.0 to 10.0 wt%, preferably 4.0 to 7.5 wt%. A processed tapioca starch content below 2.0 wt% or exceeding 10.0 wt% may cause unsatisfactory stretch ability.

[0013]

The cheese-based food of the present invention has a pH of 4.0 or more, preferably a pH of 5.0 to 6.0. A pH below 4.0 may cause unsatisfactory stretch ability.

[0014]

The cheese-based food of the present invention has a water content of 53 to 63%, preferably 55 to 59%. A water content below 53% or exceeding 63% may cause unsatisfactory stretch ability.

[0015]

The cheese-based food of the present invention, which has a high oil and fat content, has a milk fat/milk protein ratio of 2.0 or less. A milk fat/milk protein ratio of 2.0 or less

in the cheese-based food achieves the effects of the present invention. The milk fat/milk protein ratio can be adjusted according to, for example, the type or amount of the raw material cheese added or the amount of oil and fat used as an auxiliary material. The amount of milk fat or milk protein may be determined through any common method; for example, the Roese-Gottlieb method for milk fat, or the Kjeldahl method for milk protein.

[0016]

As used herein, the term "stretch ability" refers to a stretch of 10 cm or more determined through the following stretch ability test at 10°C:

(Evaluation of stretch ability)

stretch ability test: 40 g of a cheese-based food is collected in a cup, the cheese-based food is pulled up at a rate of 2.5 cm/second, and the length of an elongated string of cheese at break is measured. The stretch ability of the cheese-based food is evaluated on the basis of the determined value.

[0017]

Any auxiliary material usable for manufacturing cheese-based foods may be used in the present invention. Examples of the auxiliary material include molten salts; food additives (other than molten salts) used in cheese-based foods, such as emulsifiers, stabilizers (e.g., polysaccharide thickeners and celluloses), and flavors; milk materials serving

as milk protein sources; foodstuffs, such as starch, gelatin, and agar; animal and vegetable oils and fats for adjustment of fat content, such as butter; and seasonings used for flavoring.

[0018]

Now will be described a method for producing the cheese-based food of the present invention. The method includes a step of mixing raw material cheese with processed tapioca starch to prepare a raw material mixture; a step of adjusting the pH, water content, and milk fat/milk protein ratio of the raw material mixture so that a cheese-based food has a pH of 4.0 or more, a water content of 53 to 63%, and a milk fat/milk protein ratio of 2.0 or less; a step of thermally emulsifying the raw material mixture; and a step of cooling the thermally emulsified raw material mixture.

[0019]

In the raw material mixing step and the adjustment step, raw material cheese is mixed with processed tapioca starch to prepare a raw material mixture, the pH of the raw material mixture is adjusted to 4.0 or more, and the water content of the mixture is adjusted to 53 to 63%. The processed tapioca starch may be added alone or in combination with an auxiliary material. Thereafter, the raw material mixture having adjusted pH and water content is thermally emulsified and then cooled, to produce a cheese-based food. The pH of the cheese-based food can be adjusted to 4.0 or more with a common

pH adjuster for adjustment of the pH of cheese, such as citric acid, lactic acid, or sodium bicarbonate. The water content of the cheese-based food must be adjusted to 53 to 63%. For adjustment of the water content of the cheese-based food to 53 to 63%, the amount of water required for the raw material mixture is calculated from the water content of each raw material and the increasing amount of water during thermal emulsification, and the calculated amount of water is added to the raw material mixture. The milk fat/milk protein ratio can be adjusted depending on, for example, the type or amount of the raw material cheese added or the amount of oil and fat used as an auxiliary material.

[0020]

In the present invention, any emulsifying machine for cheese-based foodion may be used in the thermal emulsification step. Examples of the machine include a cooker emulsifier, a kettle emulsifier, a vertical high-speed shearing emulsifier, and a scraped-surface heat exchanger. Any emulsification temperature or agitation speed may be used, because the cheese-based food can be produced under typical cheese manufacturing conditions. The agitation speed is preferably 1,000 to 2,000 rpm, more preferably 1,200 to 1,800 rpm. In the subsequent cooling step, the thus-emulsified mixture is cooled after charging thereof into a mold having a shape according to the intended use of the cheese-based food. The cooling

temperature and rate are not particularly limited. Similar to the case of common cheese-based foods, the cheese-based food of the present invention is preferably cooled rapidly to and stored at 10°C or lower.

[0021]

The cheese-based food prepared according to the present invention has high oil and fat and water contents, and exhibits excellent stretch ability and flavor comparable to those of cheese in a wide temperature range; i.e., during both heating and cooling states, even at low temperatures.

[0022]

The cheese-based food produced according to the present invention can be applied to products for domestic and commercial use. Because of its excellent stretch ability in a wide temperature range, the cheese-based food can be used for pizza, hamburger steak, steamed meat bun, and topping of steamed vegetables or *takoyaki* (octopus dumpling).

EXAMPLES

[0023]

The present invention will now be described in more detail by way of Examples, which should not be construed as limiting the invention thereto.

[0024]

[Example 1]

(Effect of raw material cheese content on stretch ability)

Cheese-based foods having different raw material cheese contents were produced from domestic or imported Gouda cheese for testing. The raw material content of each cheese-based food was adjusted by controlling the amount of oil and fat added. Gouda cheese (manufactured by Megmilk Snow Brand Co., Ltd.) (2,100 to 3,900 g, 14 to 26 wt%) was milled and used as a raw material. Subsequently, processed tapioca starch (Farinex TG600: hydroxypropyl starch (etherified), manufactured by Matsutani Chemical Industry Co., Ltd.) (900 g, 6.0 wt%) was added to the raw material cheese. Sodium bicarbonate (15 g) serving as a pH adjuster was added to the raw material mixture, into a pH of 6.0. Water was added to the mixture into a final water content of 57%. A molten salt (molten sodium phosphate) (90 g) was added to the mixture, and the mixture was then melted by being heated to 85°C and emulsified with a high-shear Stephan emulsifier at 1,500 rpm. After having been heated to 85°C, the mixture was agitated at the same rotation speed for 30 seconds. The thermally emulsified mixture was placed into a mold and cooled at 5°C for 24 hours, to produce a cheese-based food of the present invention (inventive product). The cheese-based food was evaluated for stretch ability. A comparative cheese-based food was produced in the same manner as described above, except that the processed tapioca starch was replaced with the same amount of processed cornstarch (Farinex VA70C,

manufactured by Matsutani Chemical Industry Co., Ltd.).

[0025]

(Evaluation of stretch ability)

(Method)

A cheese-based food (40 g) cooled at 10°C was collected in a cup. The cheese-based food was pulled up at a rate of 2.5 cm/second, and the length of an elongated string of cheese at break was measured. The stretch ability (cooled state) of the cheese-based food was evaluated on the basis of the measured value. The stretch ability (heated state) of the cheese-based food was evaluated at 85°C. Evaluation criteria are as follows:

A: Stretch of 15 cm or more

B: Stretch of 10 cm or more and less than 15 cm

C: Stretch of 5 cm or more and less than 10 cm

D: No substantial stretch of less than 5 cm

[0026]

[Table 1]

Effect of raw material cheese content on stretch ability (milk fat/milk protein: 1.25)

Raw material cheese	Inventive product (heated)	Inventive product (cooled)	Comparative product (heated)	Comparative product (cooled)
26%	B	C	D	D
24%	B	B	D	D
22%	A	A	D	D
20%	A	A	D	D
18%	A	A	D	D

16%	B	B	D	D
14%	C	C	D	D

[0027]

Table 1 shows the results. With reference to Table 1, a cheese-based food having a raw material cheese content of 16 to 24 wt% exhibited good stretch ability and a favorable cheese-like flavor. In particular, a cheese-based food having a raw material cheese content of 18 to 22 wt% exhibited high stretch ability. The cheese-based food retained cheese-like stretch ability and flavor in both heated and cooled states.

[0028]

[Example 2]

(Effect of pH on stretch ability)

Gouda cheese (manufactured by Megmilk Snow Brand Co., Ltd.) (3,000 g) was milled and used as a raw material. Subsequently, oil and fat were added, and processed tapioca starch (Farinex TG600: hydroxypropyl starch (etherified), manufactured by Matsutani Chemical Industry Co., Ltd.) (900 g, 6.0 wt%) was added to the raw material cheese. Citric acid and sodium bicarbonate serving as pH adjusters were added to the raw material mixture, into a pH of 3.5 to 7.0. Water (6,568 g) was added to the mixture into a final water content of 57%. A molten salt (molten sodium phosphate) (90 g) was added to the mixture, and the mixture was then melted by being heated to 85°C

and emulsified with a high-shear Stephan emulsifier at 1,500 rpm. After having been heated to 85°C, the mixture was agitated at the same rotation speed for 30 seconds. The thermally emulsified mixture was placed into a mold and cooled at 5°C for 24 hours, to produce a cheese-based food of the present invention (inventive product). The cheese-based food was evaluated for stretch ability. A comparative cheese-based food was produced in the same manner as described above, except that the processed tapioca starch was replaced with the same amount of processed cornstarch (Farinex VA70C, manufactured by Matsutani Chemical Industry Co., Ltd.).

[0029]

[Table 2]

Effect of pH on stretch ability

pH	Inventive product (heated)	Inventive product (cooled)	Comparative product (heated)	Comparative product (cooled)
7.0	B	B	D	D
6.5	B	B	D	D
6.0	A	A	D	D
5.5	A	A	D	D
5.0	A	A	D	D
4.5	B	B	D	D
4.0	B	B	D	D
3.5	C	C	D	D

[0030]

Table 2 shows the results. With reference to Table 2,

a cheese-based food having a pH of 4.0 or more exhibited high stretch ability and a favorable cheese-like flavor. In particular, a cheese-based food having a pH of 5.0 to 6.0 exhibited excellent stretch ability. The cheese-based food retained cheese-like stretch ability and flavor in both heated and cooled states. The cheese-based food of the present invention had a milk fat/milk protein ratio of 1.25.

[0031]

[Example 3]

(Effect of processed tapioca starch content on stretch ability)

Gouda cheese (manufactured by Megmilk Snow Brand Co., Ltd.) (3,000 g) was milled and used as a raw material. Subsequently, oil and fat were added in an amount corresponding to the standard for milk-based food, and processed tapioca starch (Farinex TG600: hydroxypropyl starch (etherified), manufactured by Matsutani Chemical Industry Co., Ltd.) (150 to 1,800 g, 1.0 to 12.0 wt%) was mixed with the raw material cheese. Sodium bicarbonate (15 g) serving as a pH adjuster was added to the raw material mixture, into a pH of 6.0. Water was added to the mixture into a final water content of 57%. A molten salt (molten sodium phosphate) (90 g) was added to the mixture, and the mixture was then melted by being heated to 85°C and emulsified with a high-shear Stephan emulsifier at 1,500 rpm. After having been heated to 85°C, the mixture was agitated at the same rotation speed for 30 seconds. The thermally

emulsified mixture was placed into a mold and cooled at 5°C for 24 hours, to produce a cheese-based food of the present invention (inventive product). The cheese-based food was evaluated for stretch ability. A comparative cheese-based food was produced in the same manner as described above, except that the processed tapioca starch was replaced with the same amount of processed cornstarch (Farinex VA70C, manufactured by Matsutani Chemical Industry Co., Ltd.).

[0032]

[Table 3]

Effect of tapioca content on stretch ability

Tapioca content	Inventive product (heated)	Inventive product (cooled)	Comparative product (heated)	Comparative product (cooled)
12.0(%)	B	C	D	D
10.0(%)	B	B	D	D
7.5(%)	A	A	D	D
6.0(%)	A	A	D	D
4.0(%)	A	A	D	D
2.0(%)	B	B	D	D
1.0(%)	C	C	D	D

[0033]

Table 3 shows the results. With reference to Table 3, a cheese-based food having a processed tapioca starch content of 2.0 to 10.0 wt% exhibited high stretch ability and a favorable cheese-like flavor. In particular, a cheese-based food having a processed tapioca starch content of 4.0 to 7.5 wt% exhibited

excellent stretch ability. The cheese-based food retained cheese-like stretch ability and flavor in both heated and cooled states. The cheese-based food of the present invention had a milk fat/milk protein ratio of 1.25.

[0034]

[Example 4]

(Effect of water content on stretch ability)

Gouda cheese (manufactured by Megmilk Snow Brand Co., Ltd.) (3,000 g) was milled and used as a raw material. Subsequently, oil and fat were added in an amount corresponding to the standard for milk-based food, and processed tapioca starch (Farinex TG600: hydroxypropyl starch (etherified), manufactured by Matsutani Chemical Industry Co., Ltd.) (900 g, 6.0 wt%) was mixed with the raw material cheese. Sodium bicarbonate (15 g) serving as a pH adjuster was added to the raw material mixture, into a pH of 6.0. Water was added to the mixture into a final water content of 48 to 65%. A molten salt (molten sodium phosphate) (90 g) was added to the mixture, and the mixture was then melted by being heated to 85°C and emulsified with a high-shear Stephan emulsifier at 1,500 rpm. After being heated to 85°C, the mixture was agitated at the same rotation speed for 30 seconds. The thermally emulsified mixture was placed into a mold and cooled at 5°C for 24 hours, to produce a cheese-based food of the present invention (inventive product). The cheese-based food was evaluated for

stretch ability. A comparative cheese-based food was produced in the same manner as described above, except that the processed tapioca starch was replaced with the same amount of processed cornstarch (Farinex VA70C, manufactured by Matsutani Chemical Industry Co., Ltd.).

[0035]

[Table 4]

Effect of water content on stretch ability

Water content	Inventive product (heated)	Inventive product (cooled)	Comparative product (heated)	Comparative product (cooled)
65.0	C	C	D	D
63.0	B	B	D	D
59.0	A	A	D	D
57.0	A	A	D	D
55.0	A	A	D	D
53.0	B	B	D	D
50.0	B	C	D	D
48.0	C	C	D	D

[0036]

Table 4 shows the results. With reference to Table 4, a cheese-based food having a water content of 53.0 to 63.0% exhibited good stretch ability and a favorable cheese-like flavor. In particular, a cheese-based food having a water content of 55.0 to 59.0% exhibited excellent stretch ability. The cheese-based food retained cheese-like stretch ability and flavor in both heated and cooled states. The cheese-based food

of the present invention had a milk fat/milk protein ratio of 1.25.

[0037]

[Example 5]

(Effect of raw material cheese type on stretch ability)

A cheese-based food was produced as in Example 1, except that Gouda cheese, mozzarella cheese, or cheddar cheese (3,000 g) serving as a raw material was used in combination with processed tapioca starch (Farinex VA70TJ: hydroxypropylated phosphate-crosslinked starch (esterified), manufactured by Matsutani Chemical Industry Co., Ltd.). The cheese-based food was evaluated for stretch ability. Table 5 shows the results. The cheese-based food exhibited excellent stretch ability and a favorable cheese-like flavor regardless of the type of raw material cheese used. The cheese-based food retained cheese-like stretch ability and flavor in both heated and cooled states.

[0038]

[Table 5]

Effect of raw material cheese type on stretch ability

Raw material cheese	Inventive product (heated)	Inventive product (cooled)	Milk fat/milk protein
Gouda cheese	A	A	1.25
Mozzarella cheese	A	A	0.85
Cheddar cheese	A	A	1.56

[0039]

[Example 6]

Gouda cheese (manufactured by Megmilk Snow Brand Co., Ltd.) (3,000 g) was milled and used as a raw material. Subsequently, oil and fat were added in an amount corresponding to the standard for milk-based food, and processed tapioca starch (Stabilose TA-8: oxidized starch, manufactured by Matsutani Chemical Industry Co., Ltd.) (900 g, 6.0 wt%) was added to the raw material cheese. Citric acid and sodium bicarbonate serving as pH adjusters were added to the raw material mixture, into a pH of 5.5. Water was added to the mixture into a final water content of 57%. A molten salt (molten sodium phosphate) (90 g) was added to the mixture, and the mixture was then melted by being heated to 85°C and emulsified with a high-shear Stephan emulsifier at 1,800 rpm. After having been heated to 85°C, the mixture was agitated at the same rotation speed for 30 seconds. The thermally emulsified mixture was placed into a mold and cooled at 5°C for 24 hours, to produce a cheese-based food of the present invention (inventive product), which was then evaluated for stretch ability. The cheese-based food exhibited a stretch of 15 cm or more in both heated and cooled states. The cheese-based food retained excellent stretch ability and a favorable cheese-like flavor in both heated and cooled states. The cheese-based food

of the present invention had a milk fat/milk protein ratio of 1.25.

INDUSTRIAL APPLICABILITY

[0040]

The present invention can provide a cheese-based food exhibiting excellent stretch ability and flavor comparable to those of processed cheese not only in a heated state but also at low temperatures, which has not yet been achieved by conventional techniques, and a method for producing the cheese-based food. The cheese-based food produced according to the present invention can be applied to various products for domestic and commercial use.

CLAIMS

[Claim 1]

A cheese-based food comprising:
2.0 to 10.0 wt% processed tapioca starch; and
16 to 24 wt% raw material cheese,
the cheese-based food having a pH of 5.0 to
6.0, a water content of 55.0 to 59.0 %, and a fat/milk protein
ratio of 2.0 or at the most.

[Claim 2]

The cheese-based food according to claim 1, wherein the
cheese-based food comprising:
4.0 to 7.5 wt% processed tapioca starch and /or
18 to 22 wt% raw material cheese.

[Claim 3]

The cheese-based food according to claim 2, the milk
fat/milk protein ratio is 1.25 or less.

[Claim 4]

The cheese-based food according to claim 1, exhibiting
a stretch of 10 cm or more determined through the following
stretch ability test at 10°C:

stretch ability test: 40 g of the cheese-based food is
collected in a cup, the cheese-based food is pulled up at a rate
of 2.5 cm/second, and the length of an elongated string of cheese
at break is measured.

[Claim 5]

A method for producing a cheese-based food, comprising:
mixing raw material cheese with processed tapioca starch to
prepare a raw material mixture;

adjusting the pH, water content, and milk fat/milk
protein ratio of the raw material mixture such that a cheese-
based food has a pH of 5.0 to 6.0, a water content of 55.0 to
59.0%, and a fat/milk protein ratio of 2.0 at the most;

thermally emulsifying the raw material mixture; and
cooling the thermally emulsified raw material mixture.