

METHOD FOR MANUFACTURING CHEESE-LIKE FOOD

TECHNICAL FIELD

[0001] The present invention relates to a method for manufacturing a cheese-like food. More specifically, the present invention relates to a method for manufacturing a cheese-like food having a flavor and texture similar to cheese without using cheese as a main raw material.

BACKGROUND ART

[0002] Currently, various kinds of cheese are used for cooking confectionery and bread. However, since cheese is relatively expensive in raw material cost and manufacturing cost is high because fermentation of raw milk is necessary in manufacturing process, cheese-like food having a flavor and texture similar to cheese is required as a substitute. Inexpensive materials such as edible oils and fats, protein materials, starch and the like are typically used as raw materials of cheese-like foods, and manufacturing cost can be reduced because fermentation process of milk can be omitted. For example, cheese-like foods manufactured by using various kinds of casein such as rennet casein, acid casein and the like as main raw materials have been proposed (Patent Documents 1 and 2). Among them, in particular, a cheese-like food manufactured by using rennet casein as a main raw material is excellent in terms of flavor and texture.

[0003] In addition, for using in cooking of confectionery and bread, it is important for the cheese-like food to have no solidified product such as a curd (solidified product composed mainly of casein) remained after heat emulsification and to have stringiness comparable to that of a natural cheese at the time of heating, as well as to have a flavor and texture similar to cheese. Patent Document 1 discloses a method for manufacturing

a cheese-like food using rennet casein as a main raw material and excellent in stringiness. In the manufacturing method described in Patent Document 1, rennet casein is added to an aqueous solution containing a molten salt and mixed, immersed at a temperature of 0 to 45°C for 20 minutes to 5 days to adjust release of calcium ions, and a curd is made. The obtained curd is emulsified by adding edible fat.

PRECEDING TECHNICAL DOCUMENT

Patent Document:

[0004] Patent Document 1: Japanese Patent Application Laid-open No. H2-23831.

Patent Document 2: Japanese Patent Application Laid-open No. 2010-22258.

SUMMARY

Technical Problem:

[0005] However, the method for manufacturing a cheese-like food disclosed in Patent Document 1 requires immersing rennet casein in the aqueous solution containing the molten salt for 20 minutes to 5 days in order to adjust release of calcium ions contained in rennet casein as described above, which is not suitable for industrial manufacturing. In other words, an object of the manufacturing method disclosed in Patent Document 1 is to accurately control the release speed of calcium ions by selecting immersion temperature and time of the mixture of rennet casein. However, it is necessary to adjust the temperature and time minutely, and it is not suitable for manufacturing the cheese-like food continuously and in large quantity at an industrial level. In addition, it is necessary for the manufacturing method disclosed in Patent Document 1 to have the immersion time at most for 5 days, and it is necessary to wait for the immersion period to proceed to the next step. Therefore, it is difficult to manufacture the cheese-like food

continuously. Further, in a case where the cheese-like food is manufactured in large quantity by this method, it is necessary to prepare a storage facility for the immersion period, which causes unnecessary expansion of the facility and increase in a management cost.

[0006] Accordingly, an object of the present invention is to provide a method for efficiently manufacturing a cheese-like food having no solidified product remained after heat emulsification and having excellent stringiness.

Solution to Problem:

[0007] The inventors of the present invention have conducted intensive studies on means for solving the above- mentioned problems, and as a result, have gotten the following findings. Namely, in a method for manufacturing a cheese-like food, it is possible to have no solidified product remained after emulsification and to appropriately maintain stringiness of the finally obtained cheese-like food, by stirring a raw material of cheese mainly containing rennet casein with a mixer etc. at high speed and in a short time before agitation emulsification by using a normal emulsifying machine. Then, the present inventors have conceived that the conventional problems can be solved based on the above-described findings, and have completed the present invention. More specifically, the present invention includes the following steps.

[0008] The present invention relates to a method for manufacturing cheese-like food. The manufacturing method according to the present invention includes a high-speed stirring step, a stirring emulsification step, and a cooling step. The high-speed stirring step is a step for stirring a raw material of cheese containing rennet casein, edible fat, and water for 1-80 seconds at a shearing speed of $100-3000 \text{ sec}^{-1}$. In the high-speed stirring step, it is preferred that emulsification of the raw material of cheese is not achieved basically. The stirring emulsification step is a step for stirring and emulsifying, while heating, the raw material of cheese subjected to the high-speed

stirring step. The cooling step is a step for cooling the raw material of cheese subjected to the stirring emulsification step and obtaining a cheese-like food. The cooling step includes radiating heat while putting the raw material of cheese under room temperature as well as cooling the raw material of cheese by utilizing a cooling facility.

[0009] By stirring the raw material of cheese mainly containing rennet casein with a mixer etc. at high speed and in a short time before stirring emulsification while heating by using a normal emulsifying machine as the above steps, no solidified product has remained after emulsification and stringiness of the finally obtained cheese-like food has been maintained appropriately. Namely, in a case where the high-speed stirring is not performed before the stirring emulsification, the solidified product remains after emulsification of the raw material of cheese, so it is not suitable as a product. If the shearing speed in the high-speed stirring step is less than 100 sec^{-1} , the solidified product may remain. If the shearing speed is more than 3000 sec^{-1} , the stringiness decreases. Similarly, if the stirring time in the high-speed stirring step is less than 1 second, the solidified product may remain. If the stirring time exceeds 80 seconds, the stringiness decreases. Therefore, in view of solving the solidified product and maintaining the stringiness of the cheese-like food, in the high-speed stirring step, it is preferred that the shearing speed of stirring is $100\text{-}3000 \text{ sec}^{-1}$ and the stirring time is 1-80 seconds.

[0010] In the high-speed stirring step of the manufacturing method according to the present invention, the raw material of cheese is preferably maintained at room temperature without being heated. The raw material of cheese can be heated, but in that case, 60°C or less is preferred. In the manufacturing method according to the present invention, it is considered that separating the high-speed stirring step from the stirring emulsification step and stirring before the emulsification of the raw material of cheese progresses contribute to the stringiness of the final product. Therefore, in order to prevent the emulsification of the raw material of cheese in the high-speed stirring step,

the raw material of cheese is preferably maintained at room temperature without being heated.

[0011] In the manufacturing method according to the present invention, the raw material of cheese can be stirred in a negative pressure state in the high-speed stirring step.

[0012] In the manufacturing method according to the present invention, it is preferable that a speed of stirring the raw material of cheese in the stirring emulsification step is lower than a speed of stirring the raw material of cheese in the high-speed stirring step. Specifically, it is preferable that a shearing speed in the stirring emulsification step is $50\text{--}1650\text{ sec}^{-1}$ (or the stirring speed is $50\text{--}1000\text{ rpm}$). The stringiness of the cheese-like food can be maintained in good condition, by stirring the raw material of cheese at high speed in the high-speed stirring step and then stirring and emulsifying the raw material of cheese at relatively low speed in the stirring emulsification step. In the stirring emulsification step, for example, a kettle type melting machine (batch type) or a continuous melting machine can be used. In the stirring emulsification step, if the raw material of cheese is stirred at high speed by using, for example, a Stefan type emulsifying machine, there is concern that the stringiness is lowered due to collapse of constitutive fibers.

ADVANTAGEOUS EFFECT OF INVENTION

[0013] According to the present invention, it is possible to efficiently manufacture a cheese-like food having no solidified product remained after heat emulsification and having excellent stringiness.

DESCRIPTION OF EMBODIMENTS

[0014] Hereinafter, embodiments of the present invention will be described. The present invention is not limited to the embodiments described below, but includes modifications of the following embodiments appropriately modified within the scope obvious to those skilled in the art.

[0015] In the present specification, “cheese-like food” means food containing a specific amount of rennet casein, edible fat, and water as essential components and obtained by emulsifying after heating and melting the mixture thereof. It can be said that the cheese-like food is a food having taste and texture similar to various cheeses such as non-matured cheese, matured cheese, processed cheese, cheese food, and the like.

[0016] In the present specification, “A-B” means “not less than A and not more than B”.

[0017] The present invention relates to a method for manufacturing cheese-like food and includes a preparing step, the high-speed stirring step, the stirring emulsification step, and the cooling step.

[0018] The preparing step is a step for preparing the raw material of cheese-like food (referred to as “cheese raw material”). The cheese raw material used in the present invention contains a specific amount of rennet casein, edible fat, and water as main ingredients. The cheese raw material may contain protein, agar, gelatin, starch, thickening agents, pH adjusting agents, taste raw material and the like, to the extent not to impair the effects of the present invention, and may further contain natural cheese.

[0019] The rennet casein is obtained by forming a curd by adding rennet to skimmed milk, and then removing whey and drying. Generally, the rennet casein is traded in a powdered form. The rennet casein is a casein protein, and is flocculated if pH of the solution is 4.6 or less. It is preferable that the rennet casein content in the whole cheese raw material is 5% by weight or more, and may be, for example, 5-20% by weight or 8-15% by weight.

[0020] The cheese raw material may further contain acid casein, sodium caseinate, or

calcium caseinate, as casein protein same as the rennet casein. The casein protein content exemplified herein is preferably less than the rennet casein content, and may be, for example, 0.1-5% by weight or 1-4% by weight in the whole cheese raw material.

[0021] The edible fat is not particularly limited as long as it is normally used for foods, and examples thereof include vegetable fat, animal fat, and edible refined processed fat. More specifically, examples of the edible fat include vegetable fat such as corn oil, soybean oil, palm oil, linseed oil, tung oil, safflower oil, kaya oil, sunflower oil, cotton seed oil, rapeseed oil, mustard oil, sesame oil, peanut oil, olive oil, coconut oil, and the like, animal fat such as milk fat, lard, fish oil, whale oil, beef tallow, pig fat, mutton tallow, and the like, hardened oil thereof, ester-exchanged oil thereof, fractionated oil thereof, and the like. It is possible to use the above exemplified one kind or combination of two or more kinds of edible fat. It is preferable that edible fat content in the whole cheese raw material is 20% by weight or more, and may be, for example, 20-50% by weight or 30-40% by weight.

[0022] The water is normal drinking water, and the water may be directly added to the cheese raw material or moisture contained in other materials may be used. It is preferable that water content in the whole cheese raw material is 30% by weight or more, and may be, for example, 30-80% by weight or 40-60% by weight.

[0023] The protein is used as needed. The protein is not particularly limited as long as it is normally used for foods, and examples thereof include milk protein such as casein, whey, and the like, soybean protein, and fish protein. It is preferable that protein content in the whole cheese raw material is 15% by weight or less, and may be, for example, 0.1-15% by weight or 0.5-9% by weight.

[0024] The agar and gelatin are used as needed. The agar and gelatin are a thickening stabilizer and are used to harden the texture of the cheese-like food. One or both of the agar and gelatin may be used as the thickening stabilizer. It is preferable that agar content in the whole cheese raw material is 4% by weight or less, and may be, for

example, 0.1-4% by weight or 0.8-3% by weight. It is preferable that gelatin content in the whole cheese raw material is 15% by weight or less, and may be, for example, 4-15% by weight or 5-10% by weight.

[0025] The starch is used as needed. The starch is a thickening stabilizer. The starch is not particularly limited as long as it is normally used for foods, and examples thereof include potato starch, sweet potato starch, tapioca starch, corn starch, waxy corn starch, sago starch, wheat starch, rice starch, legume starch. Various modified starch derived therefrom may be used. It is preferable that starch content in the whole cheese raw material is 5% by weight or less, and may be, for example, 0.1-5% by weight or 1-3% by weight.

[0026] Other thickening agents are used in an appropriate amount as needed. The thickening agents are thickening stabilizers. Examples of the thickening agents are seaweed extract such as carrageenan and alginic acid, plant natural polymer substance such as locust bean gum, tara gum, guar gum, tamarind seed polysaccharides, gum arabic, gum tragacanth, karaya gum, pectin, soybean protein, and wheat protein, microbiological production natural polymer substance such as xanthan gum, curdlan, and gellan gum, cellulose derivative such as carboxymethyl cellulose and methyl cellulose, and processed product of seaweed extract such as sodium alginic acid.

[0027] The pH adjusting agents are used in an appropriate amount as needed to attain the cheese raw material having desired value of pH. One kind or two or more kinds selected from organic acid, inorganic acid, and fermented lactic acid bacteria are used as the pH adjusting agents. Specifically, lactic acid, adipic acid, citric acid, glucono delta lactone, gluconic acid, succinic acid, tartaric acid, acetic acid, phytic acid, malic acid, phosphoric acid and the like can be used as the organic acid or the inorganic acid, and yoghurt, sour cream and the like can be used as the fermented lactic acid bacteria. In addition, cheeses such as cream cheese, quark, cottage cheese and the like can be used as the pH adjusting agents.

[0028] As the taste raw material, for example, salt or molten salt can be used. The salt or molten salt may be added to the cheese raw material for emulsification. It is preferable that adding amount of the salt or molten salt is 5% by weight or less in the whole cheese raw material and may be 0.5-5% by weight or 1.5-3% by weight. In addition, as the taste raw material, those commonly used in the field of cheese-like food such as sodium glutamate can be adopted.

[0029] In the preparing step, the above described raw materials may be charged into a mixer or the like used in the high-speed stirring step described later in an appropriate order to obtain the cheese raw material in which these raw materials are mixed. Alternatively, in the preparing step, the cheese raw material may be moved to the mixer or the like used in the high-speed stirring step described later, after obtaining the cheese raw material by mixing the above described raw materials in another container.

[0030] The high-speed stirring step is a step for mixing the blended raw materials uniformly by stirring the cheese raw material obtained in the aforementioned preparing step at a high speed and in a short time. Stirring the cheese raw material at a high speed and in a short time before emulsifying the cheese raw material while heating prevents a solidified product such as curd from remaining as lumps after heating emulsification and maintains stringiness of the finally obtained cheese-like product. In this high-speed stirring step, the cheese raw material may be stirred by using a known mixer or a known food cutter.

[0031] In the high-speed stirring step, the cheese raw material is stirred at a shearing speed in a range of 100-3000 sec^{-1} . In particular, the shearing speed is preferably 1000-2800 sec^{-1} or 1500-2500 sec^{-1} , and more preferably 1800-2200 sec^{-1} or 2000 sec^{-1} . When representing the speed of stirring the cheese raw material in the high-speed stirring step by the number of rotation of a rotation blade provided for the mixer or the like, 5000-30000 rpm or 10000-20000 rpm is preferable. The shearing speed lower than 100 sec^{-1} in the high-speed stirring step may leave the solidified product as lumps, and

the shearing speed higher than 3000 sec^{-1} may decrease the stringiness. Accordingly, the shearing speed of stirring in the high-speed stirring step is preferably $100\text{-}3000 \text{ sec}^{-1}$.

[0032] In addition, in the high-speed stirring step, the cheese raw material is stirred for a stirring time in a range of 1-80 seconds. In particular, the stirring time is preferably 3-60 seconds, and more preferably 3-10 seconds. The stirring time shorter than 1 second in the high-speed stirring step may leave the solidified product as lumps, and the stirring time longer than 80 seconds may decrease the stringiness. Accordingly, the stirring time in the high-speed stirring step is preferably 1-80 seconds.

[0033] Further, in the high-speed stirring step, the value obtained by multiplying the shearing speed of stirring by the stirring time is preferably 3000-8000, more preferably 5000-7000, and particularly preferably 5500-6500.

[0034] In the high-speed stirring step, it is preferable that the cheese raw material is stirred without being heated, while keeping inner temperature of the mixer or the like at room temperature (about 25 degrees). Therefore, in the high-speed stirring step, the cheese raw material is kept at room temperature. For example, temperature of the cheese raw material before and after stirring in the high-speed stirring step is preferably kept in a range of 0-45 degrees or 15-35 degrees. Note that the cheese raw material may be heated, and in that case, 60 degrees or less is preferable.

[0035] In the high-speed stirring step, it is preferable that the cheese raw material is stirred under negative pressure condition, while making inside of the mixer or the like for stirring the cheese raw material negative pressure state. The “negative pressure state” mentioned here means a state in a space filled with gas having pressure lower than the atmospheric pressure, and in particular, a state where internal pressure of the mixer or the like is lower than external pressure thereof. For example, the internal pressure in the high-speed stirring step is preferably 500 Pa or less (absolute pressure) or 100 Pa or less. Note that the internal pressure of the mixer or the like for stirring the

cheese raw material may be normal pressure or positive pressure.

[0036] The stirring emulsification step is a step for emulsifying the cheese raw material subjected to the aforementioned high-speed stirring step, by stirring while heating. In the stirring emulsification step, the cheese raw material is stirred at a lower speed than in the high-speed stirring step. The stirring emulsification step is finished when the pH of the cheese raw material has reached a predetermined value (for example, pH 5.5) and emulsification has been completed. In the stirring emulsification step, it is preferable to use, for example, a kettle-type emulsifier capable of gently stirring while heating the cheese raw material. Note that the cheese raw material should not be stirred at a high speed in the stirring emulsification step, and it is not preferable to use, for example, a Stefan-type emulsifier, mixer, food cutter or the like.

[0037] It is preferable that the cheese raw material is stirred in the stirring emulsification step at a lower speed than in the aforementioned high-speed stirring step, and the shearing speed is preferably in a range of $50\text{-}1650\text{ sec}^{-1}$, for example. In particular, the shearing speed is preferably $50\text{-}1500\text{ sec}^{-1}$ or $50\text{-}1000\text{ sec}^{-1}$. The speed for stirring the cheese raw material in the stirring emulsification step is preferably $50\text{-}1000\text{ rpm}$, more preferably $75\text{-}800\text{ rpm}$, and further preferably $100\text{-}500\text{ rpm}$.

[0038] In the stirring emulsification step, for example, the kettle-type emulsifier (kettle-type melting machine) can be used. When representing the speed of stirring the cheese raw material in the stirring emulsification step by the number of rotation of a rotation blade provided for the kettle-type emulsifier (kettle-type melting machine), $50\text{-}250\text{ rpm}$ is preferable, $75\text{-}225\text{ rpm}$ is more preferable, and $100\text{-}200\text{ rpm}$ is further preferable. A shearing speed of the kettle-type emulsifier in the stirring emulsification step is preferably $50\text{-}270\text{ sec}^{-1}$, more preferably $80\text{-}240\text{ sec}^{-1}$, and further preferably $105\text{-}215\text{ sec}^{-1}$.

[0039] In the stirring emulsification step, for example, a large continuous melting machine or a small continuous melting machine can be used. When representing the

speed of stirring the cheese raw material in the stirring emulsification step by the number of rotation of a rotation blade provided for the large continuous melting machine, 100-1000 rpm is preferable, 200-750 rpm is more preferable, and 300-500 rpm is further preferable. A shearing speed of the large continuous melting machine in the stirring emulsification step is preferably $160\text{-}1650\text{ sec}^{-1}$, more preferably $320\text{-}1250\text{ sec}^{-1}$, and further preferably $480\text{-}850\text{ sec}^{-1}$. A stirring time by using the large continuous melting machine is preferably 25-90 seconds, more preferably 30-60 seconds, and further preferably 40-50 seconds. On the other hand, when representing the speed of stirring the cheese raw material in the stirring emulsification step by the number of rotation of a rotation blade provided for the small continuous melting machine, 100-1000 rpm is preferable, 200-750 rpm is more preferable, and 300-500 rpm is further preferable. A shearing speed of the small continuous melting machine in the stirring emulsification step is preferably $75\text{-}780\text{ sec}^{-1}$, more preferably $150\text{-}580\text{ sec}^{-1}$, and further preferably $230\text{-}390\text{ sec}^{-1}$. A stirring time by using the small continuous melting machine is preferably 15-60 seconds, more preferably 20-50 seconds, and further preferably 25-45 seconds.

[0040] The stirring time of the cheese raw material in the stirring emulsification step is not particularly limited, and may be terminated when the cheese raw material has reached a predetermined pH. It is possible to adjust pH of the cheese raw material to a desired value, for example, by heating the cheese raw material while stirring, gradually raising the temperature, adding a pH adjusting agent (for example, lactic acid) when the cheese raw material reaches 80-90 degrees, and mixing uniformly. The pH of the finally obtained cheese-like food is preferably adjusted, for example, in a range of 4.0-6.8, because if the pH is too low, sourness will be too strong and the flavor will be poor, whereas if the pH is too high, flavor peculiar to cheese will lack.

[0041] In the stirring emulsification step, temperature of the cheese raw material is raised to 80-90 degrees from normal temperature. In the stirring emulsification step, it

is preferable to keep the temperature higher than the temperature at the time of stirring in the high-speed stirring step, particularly 50 degrees or more, at least until the pH reaches the predetermined value. In the stirring emulsification step, the stirring time is adjusted depending on the pH of the cheese raw material, and when the kettle-type emulsifier (kettle-type melting machine) is used, the stirring time is preferably at least 3 minutes or more, and for example, may be 4-15 minutes or 6-9 minutes. In the stirring emulsification step, the stirring time is adjusted depending on the pH of the cheese raw material, and when the large continuous melting machine is used, the stirring time is preferably 25-90 seconds, more preferably 30-60 seconds, and further preferably 40-50 seconds. In the stirring emulsification step, the stirring time is adjusted depending on the pH of the cheese raw material, and when the small continuous melting machine is used, the stirring time is preferably 15-60 seconds, more preferably 20-50 seconds, and further preferably 25-45 seconds. In the stirring emulsification step, a value obtained by multiplying the shearing speed when stirring by the stirring time is preferably 3500-41300, more preferably 4000-10000, and particularly preferably 5000-7000. In the stirring emulsification step, a value obtained by multiplying the number of rotation of the rotation blade by the stirring time is preferably 150-1500, more preferably 180-1000, and particularly preferably 220-800.

[0042] The cooling step is a step for cooling the cheese raw material subjected to the aforementioned stirring emulsification step and obtaining a cheese-like food. When a cooling facility is used in the cooling step, the cheese raw material is cooled by water cooling or air cooling. In the cooling step, the cheese raw material may be left to stand at normal temperature to release heat.

[0043] The cheese-like food obtained through the cooling step is preferably sterilized (sterilization step). As a method for sterilizing the cheese-like food, methods usually used for foods can be adopted, and it is preferable to heat the cheese-like food, for example, at 75-90°C for 1-10 minutes.

[0044] The cheese-like food obtained by the manufacturing method of the present invention has excellent stringiness when melted by heating. The stringing length of the cheese-like food can be measured by the measuring method in accordance with the procedure of 1) to 3) described below.

[Method for measuring stringing length]

- 1) Shred 25g of the cheese-like food in a range of 10-30 mm in length, 5-15 mm in width, and 1.5-3 mm in thickness to obtain small pieces. Place the obtained small pieces in a circular aluminum tray with a diameter of 85 mm.
- 2) Heat the small pieces of the cheese-like food together with the tray in an oven toaster (1000 w) for 3 minutes, and then leave to stand for 30 seconds to cool.
- 3) After cooling down, mix the melted cheese-like food with a folk and lift it upward, measure the length of the string of the cheese-like food when the string breaks, and use it as the stringing length.

[0045] The cheese-like food obtained by the present invention preferably has a stringing length of 20 cm or more measured by the above-described method. In particular, the stringing length of the cheese-like food is preferably 20 cm or more, 25 cm or more, or 30 cm or more. An upper limit of the stringing length is not particularly limited, and it may be, for example, 60 cm or less.

[0046] Next, the present invention will be specifically explained with reference to examples. However, the present invention is not limited to the following examples, and various improvements based on known methods can be added.

[Example 1]

[0047] In Example 1, a plurality of kinds of cheese-like foods were made under different stirring time and constant shearing speed of the high-speed stirring step, and influence of the stirring time in the high-speed stirring step on the solidified product after the emulsification while heating and on the stringiness of the cheese-like food were investigated. Table 1 shows blending of the cheese raw material. Table 2 shows

the shearing speed and the stirring time in the high-speed stirring step and physical properties of the finally obtained cheese-like food.

[0048] [Table 1]

Name of raw material	Blending amount (g)	Blending rate (%)
Rennet casein	30	8
Sodium caseinate	12	3.2
Edible fat	125	33.5
Molten salt	1	0.3
Thickening stabilizer	9	2.3
Taste raw material	18.5	5
pH adjusting agent	5	1.3
Water	172.5	46.4
Total	373	100

[0049] [Table 2]

	Sample 1	Sample 2	Sample 3	Sample 4	Sample 5
Shearing speed (sec ⁻¹)	2000	2000	2000	2000	-
Rotation number (rpm)	20000	20000	20000	20000	-
Stirring time (seconds)	3	10	60	120	-
Viscosity (P)	170	180	400	550	210
Shred evaluation	4	4	5	5	4

Length of string (cm)	30	30	18	3	30
Baking evaluation	○	○	△	×	△
Solidified product	Not remained	Not remained	Not remained	Not remained	Remained
pH of product	5.5	5.5	5.5	5.5	5.5

[0050] For making the samples 1-4, 125g of the edible fat shown in Table 1 was put in a mixer (trade name “Mirusa” (registered trademark): Iwatani Co., Ltd.: IFM-650D). Subsequently, the powder raw materials (rennet casein, sodium caseinate, thickening stabilizer) and the taste substances (molten salt, taste raw material) shown in Table 1 were put in the same mixer. Subsequently, 172.5g of water was put in the same mixer. In this way, for the samples 1-4, cheese raw materials having the same blend were adjusted. Then, the cheese raw material of each of the samples was uniformly mixed in the mixer by stirring fast at a constant shearing speed of 2000 sec^{-1} (20000 rpm). However, regarding the stirring time, the sample 1 was 3 seconds, the sample 2 was 10 seconds, the sample 3 was 60 seconds, and the sample 4 was 120 seconds. Thereafter, 350g of each of the samples uniformly mixed was transferred to a container of a kettle-type emulsifier and was gently stirred while heating to carry out emulsification. A shearing speed (stirring speed) of the kettle-type emulsifier was 215 sec^{-1} (200 rpm). When temperature of the cheese raw material of each sample reached 80-90 degrees, 5g of the pH adjusting agent (lactic acid) shown in Table 1 was added to the cheese raw material and uniformly mixed. When pH of the cheese raw material of each sample reached 5.5, the stirring emulsification was terminated, and the cheese raw material was taken out from the kettle-type emulsifier and cooled to obtain a cheese-like food. On the other hand, when making the sample 5, fast and short-time stirring by the mixer was omitted, various raw materials were directly put in the kettle-type emulsifier and the

stirring emulsification was started. The sample 5 was subjected to the same conditions as the samples 1-4 except for omitting the high-speed stirring by the mixer. With respect to the samples 1-5, the results of examining the physical properties of the obtained cheese-like food were obtained as shown in Table 2. Note that the samples 1-3 correspond to examples of the present invention and the samples 4 and 5 correspond to comparative examples of the present invention.

[0051] As a result of examining the state of each of the cheese raw materials after completing the stirring emulsification while heating, no solidified product was found for the samples 1-4, and it was confirmed that the raw material components were well stirred. On the other hand, with respect to the sample 5 which was not subjected to the high-speed stirring by the mixer, it was confirmed that a plurality of aggregations of the solidified product was remained in the cheese raw material subjected to the stirring emulsification by heating. As described above, the sample 5 had no suitability as a commercial product because of the solidified product remained in the cheese raw material.

[0052] The length of string (cm) indicates length measured by the aforementioned “method for measuring stringing length”. If the length of string is 3 cm or more, it is suitable as a product, but the length of string is preferably 15 cm or more. Each of the sample 1 subjected to 3 seconds of high-speed stirring by the mixer and the sample 2 subjected to 10 seconds of high-speed stirring had the length of string reached 30 cm and had sufficiently high stringiness. The sample 3 subjected to 60 seconds of high-speed stirring had the length of string of 18 cm which was somewhat insufficient, but the sample 3 had a sufficient suitability as a product. On the other hand, the sample 4 subjected to 120 seconds of high-speed stirring had the length of string of 3cm. Although the sample 3 had a suitability as a product, the sample 3 was insufficient as compared with other samples.

[0053] The viscosity (P) indicates viscosity of the cheese raw material (90 degree)

melted after completion of heating by using the kettle-type emulsifier, and the viscosity was measured in accordance with JISZ8803 (viscosity measuring method of liquid). The viscosity is preferably in a range of 100-400P in view of filling suitability. When the time of high-speed stirring by the mixer is lengthened, the viscosity of the cheese raw material tends to increase. In particular, the sample 4 subjected to 120 seconds of high-speed stirring had an extremely high viscosity of 550 P and was difficult to handle for commercialization.

[0054] The value of the shred evaluation indicates a value obtained by evaluation whether the cheese-like food after cooling was properly shredded. In a case where the cheese-like food was finely shredded, the value of the shred evaluation was “5”. In a case where severe binding was observed, the value of the shred evaluation was “1”. In a case where binding was partially observed but the cheese-like food was allowable as a product, the value of the shred evaluation was “3”.

[0055] The baking evaluation indicates a baking state after heating the shredded cheese-like food for 3 minutes by the oven toaster (1000 w), in a procedure similar to 1) and 2) of the “method for measuring stringing length”. In a case where the shredded small pieces were melted well, the evaluation was “○”. In a case where the shapes of some of the shredded small pieces were observed but the cheese-like food was allowable as a product, the evaluation was “△”. In a case where the shapes of the shredded small pieces were observed almost unchanged, the evaluation was “×”. The sample 4 had the baking evaluation of “×” and had no suitability as a product.

[0056] From the results of this example, it is found that the high-speed stirring of the cheese raw material by using the mixer before the stirring emulsification by the kettle-type emulsifier causes the solidified product such as curd and the like to hardly remain after emulsification and causes the finally obtained cheese-like food to have excellent stringiness at the time of melting by heat.

[Example 2]

[0057] In Example 2, the samples 6-9 of the cheese-like food shown in Table 3 below were made with different shearing speed and stirring time in the high-speed stirring step. Table 3 shows, for each sample, the shearing speed and the stirring time in the high-speed stirring step and physical properties of the finally obtained cheese-like food. Note that, in Example 2, for all of the samples 6-9, blend of the cheese raw material was the same as the blend shown in Table 1 of Example 1. In Example 2, for all of the samples 6-9, manufacturing steps were the same as the steps described in Example 1 except for the shearing speed and the stirring time in the high-speed stirring step.

[0058] [Table 3]

	Sample 6	Sample 7	Sample 8	Sample 9
Shearing speed (sec ⁻¹)	2000	107	0	17
Rotation number (rpm)	20000	350	0	55
Stirring time (seconds)	3	60	0	600
Shearing speed × Stirring time	6000	6409	0	10072
Viscosity (P)	170	250	210	250
Shred evaluation	4	4	4	4
Length of string (cm)	30	20	30	17
Baking evaluation	○	△	△	△
Solidified product	Not remained	Not remained	Remained	Remained
pH of product	5.5	5.5	5.5	5.5

[0059] The samples 6 and 7 are examples of the present invention. The sample 6 was

the same as the sample 1 shown in Table 1 of Example 1. As for the sample 7, the shearing speed was lowered to 107 sec^{-1} in the high-speed stirring step and instead the stirring time was 60 seconds which was relatively long. When a state of the cheese raw material after completion of stirring emulsification by heating was checked, no solidified product was found, and it was confirmed that content of the raw material was well stirred. Although the sample 7 had slightly inferior stringiness and the baking evaluation as compared with the sample 6, the sample 7 had adequate suitability as a product. As described above, it was also confirmed that the sample 7 fully exhibited the effect of the present invention. The values of the samples 6 and 7 obtained by multiplying the shearing speed by the stirring time were 6000 and 6409, respectively. Therefore, it is presumed that the same effect as the present invention can be obtained by a stirring time of 3-60 seconds in the high-speed stirring step and by adjusting the shearing speed such that the value obtained by multiplying the shearing speed by the stirring time is a value around 6000, for example, 5000-7000. In the high-speed stirring step, the value obtained by multiplying the shearing speed by the stirring time is preferably 3000-8000, more preferably 5000-7000, and particularly preferably 5500-6500.

[0060] On the other hand, the samples 8 and 9 are comparative examples. The sample 8 was the same as the sample 5 shown in Table 1 of Example 1. As for the sample 9, although the high-speed stirring step was performed, the shearing speed was 17 sec^{-1} and the stirring time was 600 seconds. Even in the case where the stirring time was set as long as 600 seconds as in this sample 9, if the shearing speed was as gentle as 17 sec^{-1} , similar to the sample 8 for which the high-speed stirring step was not performed, the solidified product was present in the cheese raw material after completion of the stirring emulsification by heating, and the obtained product had no suitability as a commercial product.

[0061] From the results of this example, it was confirmed that the shearing speed in the

high-speed stirring step is preferably at least 100 sec^{-1} . In addition, it was discovered that the solidified product did not remain as lumps in the cheese raw material and the cheese-like food having suitable stringiness could be manufactured, when the stirring time in the high-speed stirring step was 3-60 seconds and the shearing speed was adjusted such that a value obtained by multiplying the shearing speed by the stirring time was 5000-7000.

[0062] As described above, in the present specification, examples of the present invention have been described in order to represent the contents of the present invention. The present invention, however, is not limited to the above examples, but encompasses modifications and improvements obvious to those skilled in the art based on the matters described in the present specification.

Industrial Applicability

[0063] The present invention relates to a method for manufacturing a cheese-like food. Accordingly, the present invention can be suitably utilized in industries manufacturing cheese-like foods.

CLAIMS

1. A method for manufacturing a cheese-like food comprising:
a high-speed stirring step for stirring a raw material of cheese containing rennet casein, edible fat, and water for 1-80 seconds at a shearing speed of $100-3000 \text{ sec}^{-1}$;
a stirring emulsification step for stirring, while heating, the raw material of cheese subjected to the high-speed stirring step to emulsify it; and
a cooling step for cooling the raw material of cheese subjected to the stirring emulsification step to obtain the cheese-like food.
2. The method according to claim 1, wherein the raw material of cheese is not heated in the high-speed stirring step.
3. The method according to claim 2, wherein a speed of stirring the raw material of cheese in the stirring emulsification step is lower than a speed of stirring the raw material of cheese in the high-speed stirring step.
4. The method according to claim 1, wherein a shearing speed in the stirring emulsification step is $50-1680 \text{ sec}^{-1}$.