

OIL-IN-WATER TYPE EMULSION

Technical Field

The present invention relates to an oil-in-water type emulsion which comprises a material containing as the main components milk protein and lactose whose ash content of in milk-origin solid matters is 11% by weight or more together with a thickening polysaccharide, and more particularly, to an oil-in-water type emulsion of a forming type having excellent flavor such as milkiness, richness, and odd flavor, and physical properties such as shape retention and hardness.

Background Art

Under recent circumstances where resource and environmental issues are increasingly discussed, only a few cheese whey or casein whey obtained as a by-product during production of cheese or casein is utilized as food because its solid matters are as low as about 6% by weight with a large amount of water as a remainder, and it is mostly discarded as it is or used as a feed for livestock. Examples of the utilization of such materials in food include a powdered product thereof, i.e., whey powder, whose composition of components is (protein: 12 % by weight, saccharides: 72% by weight, ash: 8% by weight).

However, a current issue of water pollution and environmental pollution caused by discarded whey in combination with a food resource shortage issue encourages a worldwide attempt to achieve active and extensive utilization of the whey. In addition, the whey is less expensive as compared with other dairy foods, and is an excellent material from the viewpoint of nourishment because the contents of protein and saccharides are high and energy and fat content are low as a nutritional value.

Patent Document 1 proposes a method for producing whey powder which comprises crystallizing lactose in a concentrated whey solution in advance, homogenizing it with a homogenizer to pulverize lactose crystals to 100 mesh or finer, and then spray-drying the pulverized product with a nozzle atomizer under pressure. This method is directed to the improvement of whey itself.

Patent Document 2 proposes a method for producing a cheese whey beverage which comprises using cheese whey obtained by acting a starter lactic acid bacterium on raw material milk for producing cheese which has been sterilized at 75°C for 1 to 5 minutes, or under equivalent conditions. This method is directed to obtain a beverage from whey.

Patent Document 3 proposes a food material for improving hypoalbuminemia which comprises as an active

component whey protein.

Patent Document 1: JP 8-298927 A

Patent Document 2: JP 9-131162 A

Patent Document 3: JP 10-257867 A

5 Disclosure of Invention

Problems to be solved by the Invention

An object of the invention is to provide an oil-in water type emulsion, in particular, an oil-in water type emulsion of a foaming type having excellent flavor and physical properties by using cheese whey or casein whey, which is obtained as a by-product during production of cheese or casein, in foods, in particular, in an oil-in-water type emulsion.

Means for Solving the Problems

15 The present inventors have paid attention to the emulsifiability of whey which is a raw material of milk origin and have found that whey obtained by processing conventional cheese whey or casein whey partly to raise an ash content slightly, i.e., a material which contains a material containing as the main components milk protein and lactose whose ash content in milk-origin solid matters is 11% by weight or more, can be effectively used in an oil-in-water type emulsion, and also that a combination with a thickening polysaccharide is effective for giving milkiness and richness.

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Thus, the first aspect of the present invention is an oil-in-water type emulsion which comprises a material containing as the main components milk protein and lactose whose ash content in milk-origin solid matters is 11% by weight or more and a thickening polysaccharide. The second aspect of the present invention is the oil-in-water type emulsion according to the first aspect, wherein the material containing as the main components milk protein and lactose whose ash content in the milk-origin solid matters is 11% by weight or more is contained in an amount of 0.2 to 4.0% by weight based on the total amount of the oil-in-water type emulsion. The third aspect of the present invention is the oil-in-water type emulsion according to the first aspect, wherein the thickening polysaccharide is contained in an amount of 0.01 to 0.3% by weight based on the total amount of the oil-in-water type emulsion. The fourth aspect of the present invention is the oil-in-water type emulsion according to any one of the first to third aspects, wherein 50% by weight or more of fats and oils are lauric fats and oils having an ascending melting point within a range from 23 to 38°C, and emulsifiers contain a demulsifier and a stabilizing emulsifier. The fifth aspect of the present invention is the oil-in-water type emulsion according to the fourth aspect, wherein a total amount of the emulsifiers containing a demulsifier and a stabilizing

emulsifier contained in the oil-in-water type emulsion is within a range from 0.1 to 1.0% by weight. The sixth aspect of the present invention is the oil-in-water type emulsion according to the fourth or fifth aspect, wherein the demulsifier is one or more substances selected from lecithin, sorbitan unsaturated fatty acid esters and polyglycerin unsaturated fatty acid esters, and the stabilizing emulsifier is one or more substances selected from sucrose saturated fatty acid esters, sorbitan saturated fatty acid esters and polyglycerin saturated fatty acid esters. The seventh aspect of the present invention is the oil-in-water type emulsion according to any one of the first to sixth aspects, which is a foaming type. The eighth aspect of the present invention is the oil-in-water type emulsion according to the seventh aspect, wherein the content of fats and oils is within a range from 20 to 40% by weight.

Effect of the Invention

According to the present invention, it became possible to provide an oil-in water type emulsion, in particular, an oil-in water type emulsion of a foaming type having excellent flavor and physical properties by using cheese whey or casein whey.

Best Mode for Carrying Out the Invention

The oil-in-water type emulsion of the present invention is an oil-in-water type emulsion comprising fats and oils and water, and it is necessary to contain a material containing as the main components milk protein and lactose whose ash content in the milk-origin solid matters is 11% by weight or more, together with a thickening polysaccharide.

The material containing as the main components milk protein and lactose whose ash content in milk-origin solid matters is 11% by weight or more of the present invention is a material containing as the main components milk protein and lactose which is produced by using cheese whey or casein whey obtained as a by-product during production of cheese or casein as a raw material, partly processing to remove lactose to adjust the ash content in the solid matters to 11% by weight or more, preferably 12% by weight or more, more preferably 13% by weight or more. By using this material, richer milkiness and body taste can be given. Any raw materials such as those containing water, concentrated, or concentrated and then dried into powder, can be used as long as the contents of ash in the solid matters, protein and saccharide are within the required ranges. The required ranges are, based on the solid matters, 11% by weight or more for the ash content, 6 to 28% by weight for the protein and 40 to 78% by weight for

the saccharide. Naturally, an aqueous dispersion of powder can also be used.

As powder, commercially available one can be used, and specific examples thereof include mineral concentrated whey
5 (protein: 7% by weight, saccharide: 73% by weight, ash content: 16% by weight).

Examples of the thickening polysaccharide of the present invention include carrageenan, xanthan gum, gellan gum, pectin, tamarind, guar gum, gum arabic, locust bean
10 gum, agar, furcellan, crystalline cellulose, microcrystalline cellulose, carboxymethylcellulose and the like, any of which can be used alone or in a combination of 2 or more thereof. The content of these thickening polysaccharides is preferably from 0.01 to 0.3% by weight,
15 more preferably from 0.01 to 0.2% by weight. When the amount is too small, it is difficult to sufficiently extract milkiness and richness or body taste of the material containing as the main components milk protein and lactose whose ash content in milk-origin solid matters is
20 11% by weight or more to efficiently. When the amount is too large, the polysaccharides adversely affect the texture, physical properties and the like.

Among these thickening polysaccharides, preferred are those capable of giving a thicker aqueous dispersion or
25 solution which exhibits physical properties similar to

those of a gel in a static state and exhibits flowability in a dynamic state. Specific examples thereof include carrageenan, gellan gum, pectin, agar and furcellan.

In the present invention, a material containing as the
5 main components milk protein and lactose whose ash content in milk-origin solid matters is 11% by weight or more is preferably used in an amount of 0.2 to 4.0% by weight, more preferably 0.2 to 3.0% by weight, based on the total amount of the oil-in-water type emulsion. Within this range,
10 other proteins or saccharides can appropriately be selected and used.

A smaller amount of the material in the emulsion make it difficult to obtain milkiness and richness, while a larger amount adversely affects the flavor.

15 Other proteins may be any food materials as long as they contain proteins, and examples of the food materials include food materials in the form of other than powder such as fresh milk, cow milk, special milk, fresh goat milk, pasteurized goat milk, fresh sheep milk, partially defatted
20 milk, defatted milk, processed milk, butter, cream, cheese, cream cheese, frozen-denatured cream cheese, concentrated whey, iced creams, concentrated milk, defatted concentrated milk, sugar-free condensed milk, sugar-free defatted condensed milk, sweetened condensed milk, sweetened
25 defatted condensed milk, fermented milk, lactic acid

bacteria fermented beverage, milk beverage, soymilk, whole egg, egg yolk, egg albumen, salted egg yolk, sweetened egg yolk, enzymatically treated egg yolk and the like, as well as food materials in the form of powder such as while
5 powder milk, defatted powder milk, cream powder, whey powder, protein-concentrated whey powder, butter milk powder, sweetened powder milk, formulated powder milk, casein calcium, whey protein concentrate, total milk protein, powdered whole egg, powdered egg yolk, powdered
10 egg albumen, albumen-decomposed materials, wheat protein, soybean powder, concentrated soybean protein, pea protein, maize protein, plasma protein and the like.

Examples of other saccharides include saccharides such as glucose, fructose, sucrose, maltose, enzymatically
15 saccharified syrup, lactose, reduced starch-derived saccharified materials, isomerized liquid sugar, sucrose-bound syrup, oligosaccharide, reduced saccharide polydextrose, sorbitol, reduced lactose, trehalose, xylose, xylitol, maltitol, erythritol, mannitol,
20 fructoorigosaccharide, soybean oligosaccharide, galactooligosaccharid, lactofructooligosaccharide, raffinose, lactulose, palatinose oligosaccharide, stevia, aspartame and the like. These saccharides can be used alone or in a combination of two or more thereof.

25 The fats and oils of the present invention are

preferably lauric fats and oils alone or a mixture of lauric fats and oils with non-lauric fats and oils.

Examples of the lauric fats and oils include palm oil, palm kernel oil, and hydrogenated, fractionated, or
5 interesterified fats and oils thereof, and the like.

It is preferred that lauric fats and oils having an ascending melting point within a range from 23 to 38°C, more preferably 23 to 31°C, most preferably 26 to 30°C is contained in an amount of 50% by weight or more based on
10 the fats and oils.

When lauric fats and oils are contained in a larger amount, milky and light flavor can be favorably obtained, and is further favorable in the case of that of a foaming type in view of the shape retention.

15 Examples of the non-lauric fats and oils include animal or vegetable fats and oils such as soybean oil, cottonseed oil, corn oil, safflower oil, olive oil, palm oil, rapeseed oil, rice bran oil, sesame oil, kapok oil, milk fat, lard, fish oil, whale oil and the like, as well
20 as processed fats and oils thereof such as hydrogenated, fractionated, and interesterified oil thereof, among which, one having a melting point of about 15 to 40°C is preferred.

An fats and oils content within a range as wide as 1 to 60% by weight can be applicable in the oil-in-water type
25 emulsion, and a smaller content hardly gives oil-originated

rich mouthfeel and flavor, while a larger amount deteriorates the stability of the emulsion. In the case of the oil-in-water type emulsion of a foaming type, the fats and oils content is 20 to 40% by weight, preferably 25 to 40% by weight. When the fats and oils content is too low, the foaming properties and the shape retention tend to be adversely affected in the case of the oil-in-water type emulsion of a foaming type. When the fats and oils content is too high, the oil-in-water type emulsion of a foaming type is liable to become less flowable (be plastisized).

As the emulsifier of the present invention, any emulsifier conventionally used for preparing an oil-in-water type emulsion or a foaming type oil-in-water type emulsion can be appropriately selected and used. Examples thereof include synthetic emulsifiers such as lecithin, monoglycerides, sorbitan fatty acid esters, propylene glycol fatty acid esters, polyglycerin fatty acid esters, polyoxyethylene sorbitan fatty acid esters, sucrose fatty acid esters, and the like, and any of which can be used alone or in a combination of two or more thereof.

In these emulsifiers, preferred are emulsifiers which contains a demulsifier and a stabilizing emulsifier, wherein a total amount thereof is within a range from 0.1 to 1.0% by weight based on the total amount of the oil-in-water type emulsion, the demulsifier is one or more

substances selected from lecithin, sorbitan unsaturated fatty acid esters and polyglycerin unsaturated fatty acid esters, and the stabilizing emulsifier is one or more substances selected from sucrose saturated fatty acid

5 esters, sorbitan saturated fatty acid esters and polyglycerin saturated fatty acid esters. A smaller amount of the emulsifier leads to difficulty in obtaining a stable oil-in-water type emulsion, while a larger amount leads to poor flavor.

10 In the oil-in-water type emulsion or that of a foaming type of the present invention, various salts can be used. As such a salt, hexametaphosphates, secondary phosphates, sodium citrate, polyphosphates, sodium bicarbonates, and the like can be used alone or in a combination of two or
15 more thereof. Other components such as flavors, colorants, preservatives and the like can also be used.

As a method for producing the oil-in-water type emulsion or that of a foaming type of the present invention, the emulsion can be obtained by appropriately mixing major
20 raw materials including the material containing as the main components milk protein and lactose whose ash content in milk-origin solid matters is 11% by weight or more, the thickening polysaccharide and water with other optional protein raw materials, saccharides, emulsifiers, and the
25 like, and subjecting the resulting mixture to preliminary

emulsification, pasteurization or sterilizing, and then homogenization treatments. In view of the preservation of the oil-in-water type emulsion, sterilization is preferred. Specifically, various raw materials are subjected to the preliminary emulsification at 60 to 70°C for 20 minutes (by a homomixer as an emulsifying device) and then, if necessary, to homogenization at 0 to 250 kg/cm² (by a homogenizer as an emulsifying device). Then, after subjecting to ultra high temperature instant sterilization treatment (UHT), homogenization is carried out again at 0 to 300 kg/cm², followed by cooling and then aging for about 24 hours.

In the ultra high temperature instant sterilization (UHT), there are two systems, one is an indirect system and the other is a direct heating system. Examples of the device for indirect heat treatment include, but is not limited to, APV plate-type UHT treatment apparatus (manufactured by APV Co. Ltd.), CP-UHT sterilizer (manufactured by Climaty Package Co. Ltd.), Stork tubular-type sterilizer (manufactured by Stork Food & Dairy Systems Inc.), Contherm scraped surface UHT sterilizer (manufactured by TetraPak Alfa-Laval Co. Ltd.), and the like. The direct heating sterilizing device includes, but is not limited to, a UHT sterilizer such as an ultra high temperature sterilizer (manufactured by IWAI Engineering

System Co. Ltd.), Uperization sterilizer (manufactured by TetraPak Alfa-Laval Co. Ltd.), VTIS sterilizer (manufactured by TetraPak Alfa-Laval Co. Ltd.), Lagear UHT sterilizer (manufactured by Lagear Co. Ltd.), Paralyzator (manufactured by Pash and Silkevogue Co. Ltd.), and the like. Any of which can be used.

Examples

The present invention will be illustrated further detailed in the following Examples, which are not intended to limit the spirit of the present invention. All "percents" and "parts" are by weight.

The results were evaluated according to the following methods.

Whipping time: Time required for reaching an optimally foamed state when whipping 1 kg of an oil-in-water type emulsion using a Kenwood mixer.

Overrun: $\{(\text{Weight of oil-in-water type emulsion in given volume}) - (\text{Weight of foamed article in given volume after whipping})\} \div (\text{Weight of foamed article in given volume after whipping}) \times 100$

Shape retention: The retention is evaluated after storage of a flower-shaped foamed article at 15°C for 24 hours. The evaluation is carried out according to the following 4 criteria, ⊙, ○, Δ and × in the order of better

retention.

Hardness: Twenty special panelists evaluate whether hardness after whipping is suitable for a whipped cream. The evaluation is carried out according to the following 4
5 criteria, ⊙, ○, Δ and × in the order of better conditions. The criteria shown by a largest number of the panelists were used as the results.

Flavor: Twenty special panelists evaluate milkiness, richness and odd flavor, and the evaluation is carried out
10 according to the following 4 criteria: ⊙, ○, Δ and × in the order of excellence. The averaged criteria were used as the results.

Overall evaluation of these three items were used as the flavor evaluation.

15 Example 1

An oil phase is prepared by adding, mixing and dissolving 20.0 parts of palm kernel oil (melting point: 28°C), 5.0 parts of hydrogenated palm kernel oil (melting point: 36°C), 5.0 parts of hydrogenated palm oil (melting
20 point: 31°C), 0.1 part of lecithin and 0.05 part of a polyglycerin unsaturated fatty acid ester. Separately, 1.0 part of a milk protein/lactose-containing material (mineral concentrated whey (protein: 7% by weight, saccharide: 73% by weight, ash: 16% by weight)), 3.0 parts of defatted
25 powder milk, 0.1 part of a sucrose fatty acid ester, 0.05

part of a polyglycerin saturated fatty acid ester, 0.2 part of sodium hexametaphosphate, 0.05 part of sodium hydrogen carbonate and 0.1 part of iota-carrageenan are dissolved in 65.35 parts of water to prepare an aqueous phase. The aqueous phase and the oil phase were preliminarily emulsified by stirring with a homomixer at 65°C for 30 minutes, the mixture was homogenized at 30 kg/cm², followed by UHT-sterilizing at 135 to 145°C for 2 to 7 seconds, homogenizing again at 30 kg/cm², cooling to 10°C and aging for about 24 hours to obtain an oil-in-water emulsion. The emulsion thus obtained was whipped with a Kenwood mixer and various tests were carried out. The results are summarized in Table 1.

Example 2 to Example 8

According to the same manner as that described in Example 1, oil-in-water type emulsions of the formulations shown in Table 1 were obtained. These emulsions were evaluated according to the same manner as that in Example 1. The results are summarized in Table 1.

In Example 2, 0.1 part of kappa-carrageenan was used instead of 0.1 part of iota-carrageenan used in Example 1.

In Example 3, 0.05 part of gellan gum was used instead of 0.1 part of iota-carrageenan used in Example 1 to prepare an aqueous phase.

In Example 4, 0.1 part of furcellan was used instead

of 0.1 part of iota-carrageenan used in Example 1.

In Example 5, 3.0 parts of mineral concentrated whey and 1.0 part of defatted powder milk were used instead of 1.0 part of mineral concentrated whey and 3.0 parts of
5 defatted powder milk used in Example 3.

In Example 6, 0.3 part of mineral concentrated whey and 3.7 parts of defatted powder milk were used instead of 1.0 part of mineral concentrated whey and 3.0 parts of defatted powder milk used in Example 3.

10 In Example 7, 0.1 part of a gellan gum was used instead of 0.5 part of gellan gum used in Example 3 to prepare an aqueous phase.

In Example 8, 0.2 part of a gellan gum was used instead of 0.5 part of gellan gum used in Example 3 to
15 prepare an aqueous phase.

The formulations and the results in Example 1 to Example 8 are summarized in Table 1.

Table 1

	Example 1	Example 2	Example 3	Example 4	Example 5	Example 6	Example 7	Example 8
Formulation								
Palm kernel oil (melting point: 28°C)	20	20	20	20	20	20	20	20
Hydrogenated palm kernel oil (melting point: 36°C)	5	5	5	5	5	5	5	5
Hydrogenated palm oil (melting point: 31°C)	5	5	5	5	5	5	5	5
Mineral concentrated whey	1	1	1	1	3	0.3	1	1
Defatted powder milk	3	3	3	3	1	3.7	3	3
Demulsifier lecithin	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Demulsifier polyglycerin unsaturated fatty acid ester	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Stabilizing emulsifier sucrose fatty acid ester	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Stabilizing emulsifier polyglycerin saturated fatty acid ester	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Sodium hexametaphosphate	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Sodium hydrogen carbonate	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Carrageenan (iota)	0.1	-	-	-	-	-	-	-
Carrageenan (kappa)	-	0.1	-	-	-	-	-	-
Gellan gum	-	-	0.05	-	0.05	0.05	0.01	0.2
Furcellan	-	-	-	0.1	-	-	-	-
Water	65.35	65.35	65.40	65.35	65.40	65.40	65.44	65.25
Total oil content (%)	30	30	30	30	30	30	30	30
Lauric oil and fat (%)	25	25	25	25	25	25	25	25
Lauric oil and fat/Total oil and fat content (%)	83.3	83.3	83.3	83.3	83.3	83.3	83.3	83.3
Ascending melting point of lauric oil and fat (°C)	29	29	29	29	29	29	29	29
Total emulsifier (%)	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
Results								
Whipping time	3'20"	3'40"	3'30"	3'50"	3'10"	4'00"	4'15"	3'00"
Overrun (%)	115	125	120	125	110	125	125	105
Shape retention	⊙	⊙	⊙	⊙	⊙	⊙	⊙	⊙
Hardness	⊙	⊙	⊙	⊙	⊙	⊙	⊙	⊙
Flavor	⊙	⊙	⊙	⊙	⊙	⊙	⊙	⊙
Milkiness	⊙	⊙	⊙	⊙	⊙	⊙	⊙	⊙
Richness	⊙	⊙	⊙	⊙	⊙	⊙	⊙	⊙
Odd flavor	⊙	⊙	⊙	⊙	⊙	⊙	⊙	⊙

Example 9 to Example 11

According to the same manner as that described in Example 1, oil-in-water type emulsions of the formulations shown in Table 2 were obtained. These emulsions were
5 evaluated according to the same manner as that in Example 1. The results are summarized in Table 2.

In Example 9, 15.0 parts of palm kernel oil (melting point: 28°C), 10.0 parts of hydrogenated palm oil (melting point: 31°C) and 5.0 parts of hydrogenated rapeseed oil
10 (melting point: 35°C) were used instead of 20.0 parts of palm kernel oil (melting point: 28°C), 5.0 parts of hydrogenated palm kernel oil (melting point: 36°C) and 5.0 parts of hydrogenated palm oil (melting point: 31°C) used in Example 1.

15 In Example 10, 0.08 part of a sorbitan unsaturated fatty acid ester and 0.04 part of a sorbitan saturated fatty acid ester were used instead of 0.05 part of the polyglycerin unsaturated fatty acid ester and 0.05 part of the polyglycerin saturated fatty acid ester used in Example
20 1.

In Example 11, 15.0 parts of coconut oil (melting point: 24°C), 10.0 parts of hydrogenated palm oil (melting point: 36°C) and 5.0 parts of hydrogenated palm oil
(melting point: 31°C) were used instead of 20.0 parts of
25 palm kernel oil (melting point: 28°C), 5.0 parts of

hydrogenated palm kernel oil (melting point: 36°C) and 5.0 parts of hydrogenated palm oil (melting point: 31°C) used in Example 1.

The formulations and the results in Example 9 to
5 Example 11 are summarized in Table 2.

Table 2

	Example 9	Example 10	Example 11
Formulation			
Palm kernel oil (melting point: 28°C)	15	20	-
Coconut oil (melting point: 24°C)	-	-	15
Hydrogenated palm kernel oil (melting point: 36°C)	-	5	10
Hydrogenated palm oil (melting point: 31°C)	10	5	5
Hydrogenated rapeseed oil (melting point: 35°C)	5	-	-
Mineral concentrated whey	1	1	1
Defatted powder milk	3	3	3
Demulsifier lecithin	0.1	0.1	0.1
Demulsifier sorbitan unsaturated fatty acid ester	-	0.08	-
Demulsifier polyglycerin unsaturated fatty acid ester	0.05	-	0.05
Stabilizing emulsifier sucrose fatty acid ester	0.1	0.1	0.1
Stabilizing emulsifier polyglycerin saturated fatty acid ester	-	0.04	-
Stabilizing emulsifier polyglycerin saturated fatty acid ester	0.05	-	0.05
Sodium hexametaphosphate	0.2	0.2	0.2
Sodium hydrogen carbonate	0.05	0.05	0.05
Iota-carrageenan	0.1	0.1	0.1
Water	65.35	65.33	65.35
Total oil content (%)	30	30	30
Lauric oil and fat (%)	15	25	25
Lauric oil and fat/Total oil and fat content (%)	50.0	83.3	83.3
Ascending melting point of lauric oil and fat (°C)	28	29	26
Total emulsifier (%)	0.3	0.32	0.3
Results			
Whipping time	3'10"	4'10"	3'20"
Overrun (%)	105	125	110
Shape retention	⊙	⊙	⊙
Hardness	⊙	⊙	⊙
Flavor	⊙	⊙	⊙
Milkiness	⊙	⊙	⊙
Richness	⊙	⊙	⊙
Odd flavor	⊙	⊙	⊙

Comparative 1

An oil phase is prepared by adding, mixing and dissolving 20.0 Parts of palm kernel oil (melting point: 28°C), 5.0 parts of hydrogenated palm kernel oil (melting point: 36°C), 5.0 parts of hydrogenated palm oil (melting point: 31°C), 0.1 part of lecithin and 0.05 part of a polyglycerin unsaturated fatty acid ester. Separately, 4.0 parts of defatted powder milk, 0.1 part of a sucrose fatty acid ester, 0.05 part of a polyglycerin saturated fatty acid ester, 0.2 part of sodium hexametaphosphate and 0.05 part of sodium hydrogen carbonate are dissolved in 65.45 parts of water to obtain an aqueous phase. The aqueous phase and the oil phase were preliminarily emulsified by stirring with a homomixer for 30 minutes at 65°C, the mixture was homogenized at 30 kg/cm², followed by UHT-sterilizing at 135 to 145°C for 2 to 7 seconds, homogenizing again at 30 kg/cm², cooling to 10°C and aging for about 24 hours to obtain an oil-in-water emulsion. The emulsion thus obtained was whipped with a Kenwood mixer and various tests were carried out. As a result, hardness after whipping was insufficient and the flavor was poor. The results are summarized in Table 3.

In Comparative Example 1, 4.0 parts of defatted powder milk was used instead of 1.0 part of mineral concentrated whey and 3.0 parts of defatted powder milk used in Example

1 and iota-carrageenan was not added to prepare an aqueous phase.

Comparative Example 2 to Comparative Example 4

According to the same manner as that described in
5 Example 1, oil-in-water type emulsions of the formulations shown in Table 3 were obtained. These emulsions were evaluated according to the same manner as that in Example 1. The results are summarized in Table 3.

In Comparative Examples 2, 4.0 parts of defatted
10 powder milk was used instead of 1.0 part of mineral concentrated whey and 3.0 parts of defatted powder milk employed in Example 1.

In Comparative Examples 3, iota-carrageenan used in Example 1 was not added to prepare an aqueous phase.

15 In Comparative Examples 4, 1.0 part of whey powder was used instead of 1.0 part of mineral concentrated whey used in Example 1.

The formulations and the results in Comparative
Example 1 to Comparative Example 4 are summarized in Table
20 3.

Table 3

	Comparative Example 1	Comparative Example 2	Comparative Example 3	Comparative Example 4
Formulation				
Palm kernel oil (melting point: 28°C)	20	20	20	20
Hydrogenated palm kernel oil (melting point: 36°C)	5	5	5	5
Hydrogenated palm oil (melting point: 31°C)	5	5	5	5
Mineral concentrated whey	-	-	1	-
Whey powder	-	-	-	1
Defatted powder milk	4	4	3	3
Demulsifier lecithin	0.1	0.1	0.1	0.1
Demulsifier polyglycerin unsaturated fatty acid ester	0.05	0.05	0.05	0.05
Stabilizing emulsifier sucrose fatty acid ester	0.1	0.1	0.1	0.1
Stabilizing emulsifier polyglycerin saturated fatty acid ester	0.05	0.05	0.05	0.05
Sodium hexametaphosphate	0.2	0.2	0.2	0.2
Sodium hydrogen carbonate	0.05	0.05	0.05	0.05
Iota-carrageenan	-	0.1	-	0.1
Water	65.45	65.35	65.45	65.35
Total oil content (%)	30	30	30	30
Lauric oil and fat (%)	25	25	25	25
Lauric oil and fat/Total oil and fat content (%)	83.3	83.3	83.3	83.3
Ascending melting point of lauric oil and fat (°C)	29	29	29	29
Total emulsifier (%)	0.3	0.3	0.3	0.3
Results				
Whipping time	4'00"	3'30"	3'50"	3'30"
Overrun (%)	130	120	125	120
Shape retention	○	○	○	○
Hardness	x	○	x	○
Flavor	○	Δ	○	Δ
Milkiness	○	Δ	○	○
Richness	Δ	Δ	○	Δ
odd flavor	⊙	○	⊙	Δ

Industrial Applicability

The present invention relates to an oil-in-water type emulsion which comprises a material containing as the main components milk protein and lactose whose ash content of in milk-origin solid matters is 11% by weight or more together
5 with a thickening polysaccharide, and more particularly, to an oil-in-water type emulsion of a forming type having excellent flavor such as milkiness, richness, and odd flavor, and physical properties such as shape retention and hardness.

CLAIMS

1. An oil-in-water type emulsion comprising a material containing as the main components milk protein and lactose whose ash content in milk-origin solid matters is 11% by weight or more, and a thickening polysaccharide.

2. The oil-in-water type emulsion according to claim 1, wherein the material containing as the main components milk protein and lactose whose ash content in the milk-origin solid matters is 11% by weight or more is contained in an amount of 0.2 to 4.0% by weight based on the total amount of the oil-in-water type emulsion.

3. The oil-in-water type emulsion according to claim 1, wherein the thickening polysaccharide is contained in an amount of 0.01 to 0.3% by weight based on the total amount of the oil-in-water type emulsion.

4. The oil-in-water type emulsion according to any one of claims 1 to 3, wherein 50% by weight or more of fats and oils are lauric fats and oils having an ascending melting point within a range from 23 to 38°C, and emulsifiers contain a demulsifier and a stabilizing emulsifier.

5. The oil-in-water type emulsion according to claim 4, wherein a total amount of the emulsifiers containing a demulsifier and a stabilizing emulsifier contained in the

oil-in-water type emulsion is within a range from 0.1 to 1.0% by weight.

6. The oil-in-water type emulsion according to claim 4 or 5, wherein the demulsifier is one or more substances selected from lecithin, sorbitan unsaturated fatty acid esters and polyglycerin unsaturated fatty acid esters, and the stabilizing emulsifier is one or more substances selected from sucrose saturated fatty acid esters, sorbitan saturated fatty acid esters and polyglycerin saturated fatty acid esters.

7. The oil-in-water type emulsion according to any one of claims 1 to 6, which is a foaming type.

8. The oil-in-water type emulsion according to claim 7, wherein the content of fats and oils is within a range from 20 to 40% by weight.