

OIL-IN-WATER EMULSIONS WITH LOW OIL CONTENT

Technical Field

[0001]

5 The present invention relates to an oil-in-water emulsion with low oil-and-fat content which is 10-40 wt% of oil-and-fat components, and more particularly, a whippable oil-in-water emulsion (whipping cream) used as a topping of a cake or the like, or used for a sandwiched whipping cream
10 between cakes, and a whippable oil-in-water emulsion which has high emulsion stability and whippability, and also which has an excellent shape retainability, an excellent meltability in the mouth, an excellent flavor and taste after whipping.

15

Background Art

[0002]

In recent years, there has been a demand in the field of food industry on the development of low-caloric, light
20 and soft foods and also to vary the habits of eating and increasing the intention of establishing good health. Also in a whippable oil-in-water emulsion (whipping cream), attempts to decrease the content of fatty ingredients have been made for the purpose of attaining light flavor and
25 calorie decrease.

A fresh cream used as a topping of a confectionery such as cake, or used for a sandwiched whipping cream between cakes is best in the point of taste. However, it has 40 to 50 wt% of oil-and-fat components and a high
5 calorie content. If content of the oil-and-fat component of the fresh cream is reduced, whipping property and shape retainability after whipping are deteriorated. In addition, it is expensive.

Therefore, an oil-in-water emulsion with low oil-and-
10 fat content made from vegetable oil-and-fat is recently considered. Patent document 1 proposes an oil-and-fat composition for producing a cream with low oil-and-fat content which is 40 wt% or less of oil-and-fat components that contains SUS-type triglycerides at an amount of at
15 least 25% and a lauric oil-and-fat ingredients in an amount of 5 to 60% with respect to the total weight of the oil-and-fat composition, and SFC of the oil-and-fat composition is 50% or more at 5°C, and 40% or more at 15°C. However, shape retainability of the oil-and-fat composition with low
20 oil-and-fat content after whipping is insufficient.

Patent document 2 proposes a protein-rich and low oil-and-fat content oil-in-water emulsion for whipping cream that contains an oil-and-fat in which SFC is 70% or more at 5°C and 40% or more at 15°C, and which contains 10 wt% or
25 more of non-fat milk solid components. However, it is

expensive because it is necessary to use 10 wt% or more of non-fat milk solid components.

Patent document 3 proposes an oil-and-fat for oil-in-water emulsion that contains 95 to 99.5 wt% of oil-and-fat obtained by interesterifying palm oil-and-fat and oil-and-fat consisting of liquid oil and/or lauric oil-and-fat in 40:60 to 80:20 weight ratio, and 0.5 to 5 wt% of oil-and-fat with a melting point of 55 to 65°C. However, shape retainability of the oil-and-fat with low oil-and-fat content after whipping is also insufficient.

In addition, non-patent document 1 describes as follows. "Traditionally, oil-and-fat content of whipped cream has been 45 to 50% because a cake having good shape retainability is required. Recently, the oil-and-fat content becomes about 30 to 47% because softness and lower-calorie are required and oil-and-fat content becomes lower. Generally, when an amount of oil-and-fat in whipped cream is decreased, the overrun tends to rise and the shape retainability after whipping becomes weak." Thus, it has been difficult problem that putting a whippable oil-in-water emulsion having 30 wt% or less of oil-and-fat components to practical use.

Prior Art Documents

Patent Documents

[0003]

Patent Document 1: JP 05-219887 A

Patent Document 2: JP 08-256717 A

Patent Document 3: JP 2006-254805 A

5 Non Patent Document 1: Satoshi Fujita "edible oil-and-fat - its use and edible oil-and-fat product" Saiwai Shobo Co. Ltd., published on April 5, 2000, page 238.

Summary of the Invention

10 Problems to be Solved by the Invention

[0004]

An object of the present invention is to provide a whippable oil-in-water emulsion with low oil-and-fat content that has high emulsion stability and whippability, and that has an excellent shape retainability, an excellent meltability in the mouth, and an excellent flavor and taste after whipping despite the oil-in-water emulsion has a low oil-and-fat content which is 10 to 40 wt% of oil-and-fat components.

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20 Another object of the present invention is to provide a whippable oil-in-water emulsion containing milk fat and vegetable oil-and-fat prepared by mixing an emulsion containing milk fat with said whippable oil-in-water emulsion with low oil-and-fat content.

Means for Solving the Problems

[0005]

The present inventors have intensively studied. As a result, the objects of the present invention have been achieved by using a small amount of specified oil-and-fat, a solid state oil-and-fat with a melting point of 40 to 68°C and an iodine number of 40 or less into an oil phase in which lauric oil-and-fat is 60 % or more in an oil-in-water emulsion with low oil-and-fat content which is 10 to 40 wt% of oil-and-fat components, further, by adjusting an average particle diameter of an oil-and-fat particle in the emulsion to 0.8 to 2.4 μm , and the present invention has been completed.

That is, a first aspect of the present invention is an oil-in-water emulsion with low oil-and-fat content comprising an oil-and-fat, protein and water, and a solid state oil-and-fat with a melting point of 40 to 68°C and an iodine number of 40 or less, wherein the oil-in-water emulsion has 10 to 40 wt% of oil-and-fat components, and lauric oil-and-fat content in an oil phase of the oil-in-water emulsion is 60% or more. A second aspect is the oil-in-water emulsion with low oil-and-fat content according to the first aspect, wherein the lauric oil-and-fat is non-interesterified oil-and-fat. A third aspect is the oil-in-water emulsion with low oil-and-fat content according to

the first aspect, wherein a content of the solid state oil-and-fat with respect to the oil-in-water emulsion is 0.5 to 5 wt%. A fourth aspect is the oil-in-water emulsion with low oil-and-fat content according to the first aspect,

5 wherein a total solid component of the oil-in-water emulsion is 14 to 44 wt%. A fifth aspect is the oil-in-water emulsion with low oil-and-fat content according to the first aspect, wherein the oil-in-water emulsion has 10 to 40 wt% of oil-and-fat components, a total solid

10 component of the oil-in-water emulsion is 14 to 44 wt%, and oil-and-fat component/total solid component is 0.3 or more. A sixth aspect is the oil-in-water emulsion with low oil-and-fat content according to the first aspect, further comprising an oil-and-fat which is liquid state at 20°C. A

15 seventh aspect is the oil-in-water emulsion with low oil-and-fat content according to the sixth aspect, wherein a content of the oil-and-fat which is liquid state at 20°C with respect to the oil-in-water emulsion is 0.5 to 5 wt%. An eighth aspect is the oil-in-water emulsion with low oil-

20 and-fat content according to the first aspect, wherein SFC of the oil phase is 60 to 95% at 10°C, 35 to 70% at 20°C, 20 to 40% at 25°C, and 0 to 20% at 30°C. A ninth aspect is the oil-in-water emulsion with low oil-and-fat content according to any one of the first to eighth aspects,

25 wherein the oil-in-water emulsion is whippable. A tenth

aspect is the oil-in-water emulsion with low oil-and-fat content according to the ninth aspect, wherein an overrun of the oil-in-water emulsion is 50 to 140%. An eleventh aspect is the oil-in-water emulsion with low oil-and-fat content according to the first aspect, wherein an average particle diameter of an oil-and-fat particle in the emulsion is in the range from 0.8 to 2.4 μm . A twelfth aspect is a process for producing an oil-in-water emulsion with low oil-and-fat content which comprises, blending an oil-and-fat, protein and water as a raw material, adjusting an oil-and-fat content to 10 to 40 wt%, and blending a solid state oil-and-fat with a melting point of 40 to 68°C and an iodine number of 40 or less into the oil-in-water emulsion on a blending amount of 0.5 to 5 wt% with respect to the oil-in-water emulsion, wherein a lauric oil-and-fat content in an oil phase of the oil-in-water emulsion is 60% or more. A thirteenth aspect is the process for producing an oil-in-water emulsion with low oil-and-fat content according to the twelfth aspect, which further comprises blending an oil-and-fat which is liquid state at 20°C into the oil-in-water emulsion on a blending amount of 0.5 to 5 wt% with respect to the oil-in-water emulsion. A fourteenth aspect is an oil-in-water emulsion containing milk fat and vegetable oil-and-fat comprising the oil-in-water emulsion with low oil-and-fat content according to

any one of the first to eighth aspects, and an emulsion containing milk fat.

Effects of the Invention

5 [0006]

It become possible to provide a whippable oil-in-water emulsion with low oil-and-fat content that has high emulsion stability and whippability, and that has an excellent shape retainability, an excellent meltability in
10 the mouth, and an excellent flavor and taste after whipping despite the oil-in-water emulsion has a low oil-and-fat content which is 10 to 40 wt% of oil-and-fat components. In addition, it becomes possible to provide a whippable oil-in-water emulsion with low oil-and-fat content that has
15 whippability, and shape retainability after whipping comparable to those of a conventional whipping cream which has 40 to 47 wt% of oil-and-fat content despite the oil-in-water emulsion has a low oil-and-fat content which is 10 to 40 wt% of oil-and-fat components by adjusting an average
20 particle diameter of an oil-and-fat particle in the emulsion to the range from 0.8 to 2.4 μm .

Moreover, it becomes possible to provide a whippable oil-in-water emulsion containing milk fat and vegetable oil-and-fat which has more excellent milk taste.

Mode for Carrying Out the Invention

[0007]

An oil-in-water emulsion with low oil-and-fat content of the present invention is an oil-in-water emulsion containing oil-and-fat, water and protein and having fluidity. In addition, the present invention relates to a whippable oil-in-water emulsion with low oil-and-fat content that has excellent whippability, and shape retainability after whipping. Such a whippable oil-in-water emulsion may also be called "whipping cream". When it is whipped so as to hold air bubbles therein, with a whipping tool or an exclusive mixer, it will become so called in general, "whipped cream" or " whip cream" which is in a whipping state.

[0008]

It is necessary that an oil-in-water emulsion with low oil-and-fat content of the present invention contains oil-and-fat, water and protein, the oil-in-water emulsion has 10 to 40 wt% of oil-and-fat components, lauric oil-and-fat content in an oil phase of the oil-in-water emulsion is 60% or more, and that a solid state oil-and-fat with a melting point of 40 to 68°C and an iodine number of 40 or less is contained in the oil-in-water emulsion.

Considering the light and low-calories which are objects of the present invention, oil-and-fat component is

preferably 10 to 35 wt%, more preferably 12 to 30 wt%, and further preferably 15 to 25 wt%. When the oil-and-fat component is too low, whippability and shape retainability tend to be poor when the oil-in-water emulsion is whipped.

5 When the oil-and-fat component is too high, an achievement of the object of the present invention becomes difficult.

[0009]

It is necessary that an oil-in-water emulsion with low oil-and-fat content of the present invention contains a
10 solid state oil-and-fat with a melting point of 40 to 68°C and an iodine number of 40 or less. An adding amount of the solid state oil-and-fat is small amount, preferably 0.5 to 5 wt%, more preferably 1 to 4 wt%, and further preferably 1 to 3 wt% with respect to the oil-in-water
15 emulsion.

An amount of the solid state oil-and-fat in an oil phase is preferably 2 to 25%, more preferably 2 to 20%, and further preferably 4 to 22%. When the amount of the solid state oil-and-fat is too low, whipping becomes difficult.
20 When the amount of the solid state oil-and-fat is too high, meltability in the mouth after whipping becomes poor.

A melting point of an oil-and-fat was measured in accordance with the Standard Methods for the Analysis of Fats and Oils of Japan Oil Chemists' Society (1996) 2.2.4.2
25 (slip melting point).

[0010]

Any oils-and-fats can be used as a solid state oil-and-fat of the present invention as long as the oil-and-fat has a melting point of 40 to 68°C and an iodine number of 40 or less. As a raw material oil-and-fat, lauric oils-and-fats which are mainly composed of lauric acid, palm oils-and-fats which are mainly composed of palmitic acid, and hardened vegetable oils which are mainly composed of fatty acid having 18 or more of carbon atoms can be included. More specifically, examples of the lauric oils-and-fats include, for example, coconut oil and palm kernel oil, and a fractionated oil obtained therefrom by fractionation such as palm kernel olein and palm kernel stearin, and a hardened oil thereof and the like, and one type or two or more types can be selected therefrom for use.

[0011]

Examples of the palm oils-and-fats include palm oil, and a fractionated oil such as palm stearin and palm olein obtained from fractionation of palm oil, as well as a hardened oil thereof and the like, and one type or two or more types can be selected therefrom for use.

Examples of vegetable oils-and-fats for the hardened vegetable oils include soybean oil, rapeseed oil, sunflower seed oil, cotton seed oil, peanuts oil, rice bran oil, corn oil, safflower oil, olive oil, kapok oil, sesame oil, and

evening primrose oil, and one type or two or more types can be selected therefrom for use.

[0012]

Among the solid state oils-and-fats, more preferably,
5 lauric oils-and-fats which are mainly composed of lauric acid, palm oils-and-fats which are mainly composed of palmitic acid, and hardened vegetable oils which are mainly composed of fatty acid having 18 or more of carbon atoms, having a melting point of 40 to 68°C and an iodine number
10 of 10 or less, further preferably, lauric oils-and-fats which are mainly composed of lauric acid, palm oils-and-fats which are mainly composed of palmitic acid, and hardened vegetable oils which are mainly composed of fatty acid having 18 or more of carbon atoms, having a melting
15 point of 40 to 68°C and iodine number of 2 or less, and most preferably, lauric oils-and-fats which are mainly composed of lauric acid having a melting point of 40 to 68°C and iodine number of 2 or less are preferable.

[0013]

20 It is necessary that an oil-in-water emulsion with low oil-and-fat content of the present invention contains lauric oil-and-fat of which content in an oil phase of the oil-in-water emulsion is 60% or more. When lauric oil-and-fat is used as a solid state oil-and-fat, this lauric oil-
25 and-fat is obviously included in the lauric oil-and-fat in

an oil phase.

Examples of the lauric oils-and-fats other than solid state oils-and-fats include, for example, coconut oil and palm kernel oil, and a fractionated oil obtained therefrom
5 by fractionation such as palm kernel olein and palm kernel stearin, and a hardened oil thereof and the like, and one type or two or more types can be selected therefrom for use.

Lauric oil-and-fat content in an oil phase is preferably 70% or more, more preferably 80% or more. When
10 lauric oil-and-fat content in an oil phase is low, shape retainability after whipping becomes poor as a whippable oil-in-water emulsion.

Lauric oil-and-fat of the present invention is preferably non-interesterified oil-and-fat.

15 [0014]

It is preferable that an oil-in-water emulsion with low oil-and-fat content of the present invention contains an oil-and-fat which is liquid state at 20°C. An adding amount of the oil-and-fat which is liquid state at 20°C is
20 small amount, preferably 0.5 to 5 wt%, more preferably 1 to 4 wt%, and further preferably 1 to 3 wt% with respect to the oil-in-water emulsion.

An amount of the oil-and-fat which is liquid state at 20°C in an oil phase is preferably 2 to 30%, more
25 preferably 3 to 27%, and further preferably 4 to 25%. When

the amount of the oil-and-fat which is liquid state at 20°C is too low, whipping becomes difficult as a whipping oil-in-water emulsion. When the amount of the oil-and-fat which is liquid state at 20°C is too high, shape retainability of the whippable oil-in-water emulsion tends to be poor.

An oil-and-fat which is liquid state at 20°C means an oil-and-fat which maintains liquid state by visual observation after the steps putting 50 g of oil-and-fat which is completely melted at 80°C in 100ml-volume beaker, followed by standing the oil-and-fat at 20°C for 24 hours. More specifically, examples of the oil-and-fat include soybean oil, cotton seed oil, corn oil, safflower oil, olive oil, palm low-melting point fraction, rapeseed oil, rice bran oil, sesame oil, and kapok oil and one type or two or more types can be selected therefrom for use.

A melting point of the oil-and-fat which is liquid state at 20°C is preferably 5 to 25°C, further preferably 7 to 23°C, most preferably 10 to 22°C.

[0015]

As a process for producing an oil-in-water emulsion with low oil-and-fat content of the present invention, process for producing conventional cream can be applied. More specifically, a process includes that 10 to 40 wt% of oil-and-fat, protein and water are main raw materials,

lauric oil-and-fat content in an oil phase of the oil-in-water emulsion is 60 % or more, and that a solid state oil-and-fat with a melting point of 40 to 68°C and an iodine number of 40 or less is blended into the oil-in-water
5 emulsion on a blending amount of 0.5 to 5 wt% with respect to the oil-in-water emulsion.

[0016]

In the oil-in-water emulsion with low oil-and-fat content of the present invention, total amount of a solid
10 state oil-and-fat with a melting point of 40 to 68°C and an iodine number of 40 or less and an oil-and-fat which is liquid state at 20°C is preferably 35% or less in an oil phase.

SFC of an oil phase is preferably 60 to 95 % at 10°C,
15 35 to 70% at 20°C and 0 to 20% at 30°C.

Measurement of the SFC (solid fat content) of an oil phase can be performed in conformity with IUPAC2.150 (Solid Content Determination in Fats by NMR).

[0017]

20 In the present invention, total solid component is preferably 14 to 44 wt%, more preferably 16 to 42 wt%, further preferably 18 to 40 wt%, and most preferably 18 to 38 wt%. When the total solid component is too low, taste after whipping is watery. When the total solid component
25 is too high, meltability in the mouth becomes poor.

[0018]

In the present invention, the oil-and-fat component and the total solid component are in the specific range, and oil-and-fat component/total solid component is
5 preferably 0.3 or more, more preferably 0.4 or more, further preferably 0.5 or more, and most preferably 0.6 or more. When oil-and-fat component/total solid component is too low, taste becomes poor.

[0019]

10 Examples of the total solid components of the present invention include oil-and-fat, protein, sugar, polysaccharide thickener, emulsifier, salt, flavor, coloring agent, preservative, and the like.

Examples of the proteins of the present invention
15 include milk protein, egg protein, soybean protein and the like, and preferably, milk protein, and more preferably, protein derived from non-fat milk solid components.

More specifically, examples of the milk proteins include fresh milk, cow milk, defatted milk, fresh cream,
20 concentrated milk, evaporated milk, condensed milk, whole milk powder, defatted milk powder, butter milk powder, whey protein, casein such as acid casein, rennet casein, casein sodium, casein calcium and casein potassium, and total milk protein. Examples of the egg proteins include liquid or
25 dried egg yolk, egg albumen, whole egg and isolated single

(simple) protein therefrom, for example, ovalbumin, conalbumin, ovomucoid, ovoglobulin, and the like. Examples of the soybean proteins include soybean milk, defatted soybean flour, soybean protein concentrate, soybean protein isolate, defatted soybean milk powder, soybean protein hydrolysate, and the like.

Examples of the proteins derived from non-fat milk solid components include fresh milk, cow milk, defatted milk, fresh cream, concentrated milk, evaporated milk, condensed milk, whole milk powder, defatted milk powder, butter milk powder, whey protein and the like. An amount of the protein is preferably 0.3 to 7 wt%, more preferably 0.3 to 6 wt%, and further preferably 0.3 to 5 wt%. When amount of protein is too low, emulsion stability of the oil-in-water emulsion with low oil-and-fat content becomes poor. When amount of protein is too high, it tends to cause deterioration of taste in a sterilization step.

In addition, in the case where non-fat milk solid component, amount thereof is preferably 0.5 to 12 wt%, more preferably 1 to 9 wt%, and further preferably 2 to 8 wt%.

[0020]

Examples of the sugars of the present invention include sucrose, fructose, glucose, lactose, maltose, invert sugar, trehalose, sugar alcohol, corn syrup, starch syrup, dextrin and the like. Examples of the sugar

alcohols include monomeric sugar alcohols such as erythritol, mannitol, sorbitol and xylitol, dimeric sugar alcohols such as isomaltitol, maltitol and lactitol, trimeric sugar alcohols such as maltotriitol, isomaltotriitol and pannitol, tetre- or more meric sugar alcohols such as oligosaccharide alcohol, reduced starch and decomposed products of reduced starch.

Lactose which coexists with protein is included in the sugars of the present invention.

10 An amount of the sugars is preferably about 0.5 to 20 wt%, more preferably 0.5 to 10 wt%, further preferably 0.5 to 6 wt%, and most preferably 0.5 to 4.5 wt%.

[0021]

Polysaccharide thickeners of the present invention are preferably one or two or more of polysaccharide thickeners selected from gellan gum, xanthan gum, locust bean gum, pullulan, guar gum, psyllium seed gum, water-soluble soybean polysaccharides, carrageenan and tamarind seed gum, more preferably, one or two or more of polysaccharide thickeners selected from gellan gum, xanthan gum, pullulan, guar gum, psyllium seed gum, water-soluble soybean polysaccharides, carrageenan and tamarind seed gum.

20 [0022]

As the emulsifier in the present invention, a conventional emulsifier used for preparing a whippable oil-

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in-water emulsion can be used as appropriate. Examples of the emulsifier include synthetic emulsifiers such as lecithin, monoglyceride, sorbitan fatty acid ester, propylene glycol fatty acid ester, polyglycerin fatty acid ester, polyoxyethylene sorbitan fatty acid ester, sucrose fatty acid ester and the like, and one or more of them can be selected and then used as appropriate.

[0023]

In the oil-in-water emulsion with low oil-and-fat content of the present invention, it is preferred to use various salts, and preferred to use alone or in combination of two or more of hexametaphosphate, dibasic phosphate, sodium citrate, polyphosphate, sodium bicarbonate and so on.

In addition, if desired, flavor, colorant and/or preservative can be used.

[0024]

As a process for producing an oil-in-water emulsion with low oil-and-fat content of the present invention, process for producing conventional cream can be applied.

More specifically, a process includes that 10 to 40 wt% of oil-and-fat, protein and water are main raw materials, lauric oil-and-fat content in an oil phase of the oil-in-water emulsion is 60 % or more, and a solid state oil-and-fat with a melting point of 40 to 68°C and an iodine number of 40 or less is blended into the oil-in-water emulsion on

a blending amount of 0.5 to 5 wt% with respect to the oil-in-water emulsion, and that these materials are mixed, pre-emulsified, pasteurized or sterilized, and then homogenized to obtain the oil-in-water emulsion.

5 An average particle diameter of an oil-and-fat particle in the oil-in-water emulsion with low oil-and-fat content is preferably in the range from 0.8 to 2.4 μm , more preferably in the range from 1.0 to 2.0 μm , and further preferably in the range from 1.0 to 1.8 μm . When the
10 average particle diameter is too small, an overrun after whipping tends to be high. When the average particle diameter is too large, emulsion stability becomes poor.

 The oil-in-water emulsion is preferably sterilized considering the preserving property.

15 [0025]

 There are two types of sterilization treatment, that is, an indirect heating mode and a direct heating mode. Examples of an apparatus for the indirect heating treatment include, but not limited to, an APV plate-type UHT
20 treatment apparatus (manufactured by APV Co., Ltd.), a CP-UHT sterilization apparatus (manufactured by Climaty Package Co., Ltd.), a Stork tubular-type sterilization apparatus (manufactured by Stork), a Contherm scraping-type UHT sterilization apparatus (manufactured by Tetrapak Alfa
25 Laval) and the like. Examples of the direct heating-type

sterilization apparatus include an ultrahigh temperature sterilization apparatus (manufactured by IWAI KIKAI KOGYO CO., LTD), a uperization sterilization apparatus (manufactured by Tetrapak Alfa Laval), a VTIS sterilization apparatus (manufactured by Tetrapak Alfa Laval), a Lagear UHT sterilization apparatus (manufactured by Lagear), a Paralizador (manufactured by Pash and Silkeborg) and the like, and any of these apparatuses may be used..

[0026]

Preferably, an overrun for the whippable oil-in-water emulsion with low oil-and-fat content of the present invention is 50 to 140%, preferably 60 to 130%, more preferably 70 to 120%, and most preferably 70 to 110%. When the overrun is too high, the texture is too light, and there is a tendency for the flavor to be thin. When the overrun is too low, the texture is too heavy, and it is difficult to obtain a desirable flavor or meltability in the mouth.

[0027]

The whippable oil-in-water emulsion with low oil-and-fat content of the present invention has whippability, shape retainability after whipping and texture after whipping comparable to those of a conventional whipping cream which has 40 to 47 wt% of oil-and-fat content despite the oil-in-water emulsion has a low oil-and-fat content

which is 10 to 40 wt% of oil-and-fat components. It is inferable that such an excellent effect is obtained by using a small amount of a solid state oil-and-fat with a melting point of 40 to 68°C and an iodine number of 40 or less and thereby the solid state oil-and-fat is eccentrically-located around of an interface of an oil-and-fat particle in the emulsion, although this inference largely depends on empirical rules led by repeating trial and error many times.

10 [0028]

In the whippable oil-in-water emulsion with low oil-and-fat content of the present invention, a lauric oil-and-fat, a solid state oil-and-fat and an oil-and-fat which is liquid state at 20°C are used as major oil-and-fat materials. When milk taste is desired, milk fat can be used with limits of less than 30% in the oil phase.

A property of the milk fat is partially same as a property of oil-and-fat mixture of a lauric oil-and-fat with an oil-and-fat which is liquid state at 20°C.

20 The milk fat includes milk fat derived from milk such as fresh milk, fresh cream and butter, as well as butter oil which is obtained by processing thereof.

[0029]

In addition, when milk taste is desired, a whippable oil-in-water emulsion containing milk fat and vegetable

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oil-and-fat can be obtained by mixing an emulsion containing milk fat with the whippable oil-in-water emulsion with low oil-and-fat content of the present invention.

5 The emulsion containing milk fat of the present invention can be any emulsions as long as the emulsion contains milk fat, and examples thereof include fresh cream, compound cream and the like. In addition, an arbitrarily-
10 configured emulsion obtained by using fresh milk, fresh cream, butter, butter oil, animal-derived oil-and-fat, plant-derived oil-and-fat and the like can be used.

 In the mixing of the emulsion containing milk fat with the whippable oil-in-water emulsion with low oil-and-fat content of the present invention, mixing ratio is not
15 limited. Also, a time of mixing is not limited, but preferably, it is preferable that the emulsion containing milk fat is mixed after emulsifying and cooling the whippable oil-in-water emulsion with low oil-and-fat content.

20 Examples

[0030]

 The present invention will be described in more detail below by way of examples of the present invention, but the spirit of the present invention is not limited by the
25 following examples. In the examples, both of % and part

mean a weight basis.

Method of evaluating oil-in-water emulsion

The viscosity of an oil-in-water emulsion,
plasticization test (stability of an oil-in-water emulsion),
5 and an average particle diameter were evaluated.

Viscosity: Measurement of the viscosity of an oil-in-water emulsion was performed with a B type viscometer (manufactured by TOKYO KEIKI Co., Ltd.) with a No.2 rotor at 30 rpm.

10 Plasticization test: 50 g of an oil-in-water emulsion was put into a 100 ml-volume beaker, and incubated at 20°C for 2 hours, and thereafter, the presence or the absence of occurrence of plasticization at stirring for 5 minutes was confirmed.

15 Average particle diameter: An oil-in-water emulsion is diluted with distilled water to measurable concentration, and then subjected to measurement with a laser diffraction type particle size distribution analyzer (SALD-2200A: manufactured by Shimadzu Corporation). The average value
20 output as data was assumed to be an average particle diameter.

[0031]

Method of evaluation when oil-in-water emulsion is whipped

25 (1) Whipping time: A time until 1 kg of the oil-in

water emulsion was whipped with a Hobart mixer (MODEL N-5 manufactured by HOBART CORPORATION) at the third gear (300 rpm), and the emulsion reached the optimum whipping state, and a time during which the emulsion was mildly mixed at
 5 the second gear (130 rpm)

(2) Overrun: $[(\text{weight of oil-in-water emulsion per given volume}) - (\text{weight of whipped product after whipping per given volume})] \div (\text{weight of whipped product after whipping per given volume}) \times 100$

10 (3) Shape retainability: Fineness of a flower-shaped whipped product after storage at 15°C for 24 hours

Four-stage evaluation A; good, B; slightly good
 C; slightly bad, D; bad (not practical)

15 (4) Water separation: The water separation state was simultaneously evaluated with the evaluation of shape retainability

Four-stage evaluation A; Absent, B; Almost absent
 C; Present, D; Very many

Method of evaluation of taste and flavor

20 The meltability in the mouth, milk taste and taste of whipped cream were evaluated.

(5) Taste

Five-stage evaluation 5; good, 4; slightly good
 3; acceptable, 2; slightly bad, 1; bad

25 (6) Meltability in the mouth

Five-stage evaluation 5; good, 4; slightly good
3; acceptable, 2; slightly bad, 1; bad

[0032]

Example 1

5 To 12 parts of hardened coconuts oil (melting point
33°C), 2 parts of hardened palm kernel oil (melting point
42°C, iodine number 1.0 or less), 1 part of rapeseed
hardened oil (melting point 17°C) were added 0.25 part of
lecithin, and 0.10 part of polyglycerin unsaturated fatty
10 acid ester (trade name SY Glyster MO-3S, manufactured by
Sakamoto Yakuhin Kogyo Co., Ltd.), and then mixed and
melted to obtain an oil phase.

Separately, in 81.1 parts of water were dissolved 3
parts of defatted milk powder, 0.12 part of sucrose
15 saturated fatty acid ester (trade name: S-570, manufactured
by Mitsubishi-Kagaku Foods Corporation), 0.05 part of
polyglycerin saturated fatty acid ester (trade name SY
Glyster MS-5S, manufactured by Sakamoto Yakuhin Kogyo Co.,
Ltd.), 0.2 part of sodium hexametaphosphate, 0.02 part of
20 sodium bicarbonate, 0.05 part of xanthan gum, 0.05 part of
guar gum, 0.1 part of milk flavor to prepare an aqueous
phase.

The oil phase and the aqueous phase were stirred with
a Homomixer at 65°C for 30 minutes to be pre-emulsified,
25 and then the resultant was subjected to sterilization

treatment by direct heating at 144°C for 4 seconds with an ultra high temperature sterilization apparatus (manufactured by Iwai Kikai Kogyo Co., Ltd.), then homogenized at a homogenization pressure of 4 MPa, and immediately cooled to 10°C. After cooling, this was aged for about 24 hours to obtain a whippable oil-in-water emulsion.

To 1 kg of this whippable oil-in-water emulsion was added 80 g of granulated sugar, this was whipped by the aforementioned whipping method, and overrun, shape retainability and water separation were measured according to the aforementioned method. In addition, taste and the meltability in the mouth of the whipped cream were evaluated.

The results were summarized in Table 1.

[0033]

Example 2

A whippable oil-in-water emulsion of Example 2 was obtained according to the formulation and method of Example 1 except that 12 parts of hardened coconuts oil, 0.10 part of polyglycerin unsaturated fatty acid ester and 81.1 parts of water were changed to 17 parts of hardened coconuts oil, 0.08 part of polyglycerin unsaturated fatty acid ester and 76.1 parts of water. Evaluation was performed according to the same manner as that of Example 1. The results were

summarized in Table 1.

Example 3

A whippable oil-in-water emulsion of Example 3 was obtained according to the formulation and method of Example 1 except that 12 parts of hardened coconuts oil, 0.10 part of polyglycerin unsaturated fatty acid ester and 81.1 parts of water were changed to 22 parts of hardened coconuts oil, 0.05 part of polyglycerin unsaturated fatty acid ester and 71.1 parts of water. Evaluation was performed according to the same manner as that of Example 1. The results were summarized in Table 1.

[0034]

Formulations and the results of Example 1 to Example 3 were summarized in Table 1.

[Table 1]

(MP melting point, IN iodine number)	Example 1	Example 2	Example 3
Hardened palm kernel oil (MP 33°C)	12	17	22
Palm kernel oil (MP 29°C)	-	-	-
Palm fractionated hardened oil (MP 45°C, IN 36)	-	-	-
Rapeseed hardened oil (MP 62°C, IN 1.0 or less)	-	-	-
Palm kernel fractionated hardened oil (MP 43°C, IN 1.0 or less)	-	-	-
Hardened palm kernel oil (MP 42°C, IN 1.0 or less)	2	2	2
Palm fractionated oil (MP 21°C)	-	-	-
Rapeseed hardened oil (MP 17°C)	1	1	1
Lecithin	0.25	0.25	0.25
Polyglycerin unsaturated fatty acid ester	0.10	0.08	0.05
Defatted milk powder	3	3	3
Dextrin	-	-	-
Starch syrup	-	-	-
Sorbitol	-	-	-
Sucrose saturated fatty acid ester	0.12	0.12	0.12
Polyglycerin saturated fatty acid ester	0.05	0.05	0.05
Sodium hexametaphosphate	0.20	0.20	0.20
Sodium bicarbonate	0.02	0.02	0.02
Xanthan gum	0.05	0.05	0.05
Guar gum	0.05	0.05	0.05
Tamarind seed gum	-	-	-
Carrageenan	-	-	-
Gellan gum	-	-	-
Milk flavor	0.10	0.10	0.10
Water	81.1	76.1	71.1
Oil-and-fat component (wt%)	15	20	25
Lauric oil-and-fat (wt%)	14	19	24
Lauric oil-and-fat/Oil-and-fat component (wt%)	93	95	96
Solid state oil-and-fat (wt%)	2	2	2
Total solid component (wt%)	19	24	29
Oil-and-fat component/Total solid component	0.8	0.8	0.8
SFC 10°C	85	86	87
SFC 20°C	60	60	60
SFC 25°C	28	27	26
SFC 30°C	10	9	9
Viscosity (cp)	370	280	350
Plasticization test	5 min. or longer	5 min. or longer	5 min. or longer
Average particle diameter (μm)	1.3	1.4	1.5
Whipping time	3 min. 50 sec.	3 min. 15 sec.	3 min. 05 sec.
Overrun (%)	105	100	100
Shape retainability	B	A	A
Water separation	B	B	A
Taste	4	4	4
Meltability in the mouth	5	5	5

[0035]

Example 4

A whippable oil-in-water emulsion of Example 4 was obtained according to the formulation and method of Example 1 except that 12 parts of hardened coconuts oil (melting point 33°C), 2 parts of hardened palm kernel oil (melting point 42°C, iodine number 1.0 or less), 1 part of rapeseed hardened oil (melting point 17°C), 0.10 part of polyglycerin unsaturated fatty acid ester and 81.1 parts of water were changed to 13 parts of hardened coconuts oil (melting point 33°C), 2 parts of palm fractionated hardened oil (melting point 45°C, iodine number 36), 5 parts of rapeseed hardened oil (melting point 17°C), 0.07 part of polyglycerin unsaturated fatty acid ester and 76.1 parts of water. Evaluation was performed according to the same manner as that of Example 1. The results were summarized in Table 2.

[0036]

Example 5

A whippable oil-in-water emulsion of Example 5 was obtained according to the formulation and method of Example 1 except that 12 parts of hardened coconuts oil (melting point 33°C), 2 parts of hardened palm kernel oil (melting point 42°C, iodine number 1.0 or less), 0.10 part of polyglycerin unsaturated fatty acid ester and 81.1 parts of

water were changed to 17 parts of hardened coconuts oil (melting point 33°C), 2 parts of palm fractionated hardened oil (melting point 45°C, iodine number 36), 0.08 part of polyglycerin unsaturated fatty acid ester and 76.1 parts of water. Evaluation was performed according to the same manner as that of Example 1. The results were summarized in Table 2.

[0037]

Example 6

10 A whippable oil-in-water emulsion of Example 6 was obtained according to the formulation and method of Example 1 except that 12 parts of hardened coconuts oil (melting point 33°C), 2 parts of hardened palm kernel oil (melting point 42°C, iodine number 1.0 or less), 0.10 part of polyglycerin unsaturated fatty acid ester and 81.1 parts of water were changed to 17 parts of hardened coconuts oil (melting point 33°C), 2 parts of rapeseed hardened oil (melting point 62°C, iodine number 1.0 or less), 0.08 part of polyglycerin unsaturated fatty acid ester and 76.1 parts of water. Evaluation was performed according to the same manner as that of Example 1. The results were summarized in Table 2.

[0038]

25 Formulations and the results of Example 4 to Example 6 were summarized in Table 2.

[Table 2]

(MP melting point, IN iodine number)	Example 4	Example 5	Example 6
Hardened palm kernel oil (MP 33°C)	13	17	17
Palm kernel oil (MP 29°C)	-	-	-
Palm fractionated hardened oil (MP 45°C, IN 36)	2	2	-
Rapeseed hardened oil (MP 62°C, IN 1.0 or less)	-	-	2
Palm kernel fractionated hardened oil (MP 43°C, IN 1.0 or less)	-	-	-
Hardened palm kernel oil (MP 42°C, IN 1.0 or less)	-	-	-
Palm fractionated oil (MP 21°C)	-	-	-
Rapeseed hardened oil (MP 17°C)	5	1	1
Lecithin	0.25	0.25	0.25
Polyglycerin unsaturated fatty acid ester	0.07	0.08	0.08
Defatted milk powder	3	3	3
Dextrin	-	-	-
Starch syrup	-	-	-
Sorbitol	-	-	-
Sucrose saturated fatty acid ester	0.12	0.12	0.12
Polyglycerin saturated fatty acid ester	0.05	0.05	0.05
Sodium hexametaphosphate	0.20	0.20	0.20
Sodium bicarbonate	0.02	0.02	0.02
Xanthan gum	0.05	0.05	0.05
Guar gum	0.05	0.05	0.05
Tamarind seed gum	-	-	-
Carrageenan	-	-	-
Gellan gum	-	-	-
Milk flavor	0.10	0.10	0.10
Water	76.1	76.1	76.1
Oil-and-fat component (wt%)	20	20	20
Lauric oil-and-fat (wt%)	13	17	17
Lauric oil-and-fat/Oil-and-fat component (wt%)	65	85	85
Solid state oil-and-fat (wt%)	2	2	2
Total solid component (wt%)	24	24	24
Oil-and-fat component/Total solid component	0.8	0.8	0.8
SFC 10°C	90	90	91
SFC 20°C	63	62	64
SFC 25°C	29	27	31
SFC 30°C	12	11	16
Viscosity (cp)	360	300	320
Plasticization test	5 min. or longer	5 min. or longer	5 min. or longer
Average particle diameter (μm)	1.5	1.3	1.3
Whipping time	3 min. 40 sec.	3 min. 35 sec.	3 min. 45 sec.
Overrun (%)	110	105	110
Shape retainability	B	A	A
Water separation	B	B	A
Taste	4	4	4
Meltability in the mouth	5	5	4

[0039]

Example 7

A whippable oil-in-water emulsion of Example 7 was obtained according to the formulation and method of Example 1 except that 12 parts of hardened coconuts oil, 1 part of rapeseed hardened oil (melting point 17°C) and 0.05 part of guar gum were changed to 12 parts of palm kernel oil (melting point 29°C), 1 part of palm fractionated oil (melting point 21°C) and 0.05 part of gellan gum.

Evaluation was performed according to the same manner as that of Example 1. The results were summarized in Table 3.

[0040]

Example 8

A whippable oil-in-water emulsion of Example 8 was obtained according to the formulation and method of Example 1 except that 12 parts of hardened coconuts oil, 1 part of rapeseed hardened oil (melting point 17°C), 0.10 part of polyglycerin unsaturated fatty acid ester, 0.05 part of guar gum and 81.1 parts of water were changed to 17 parts of palm kernel oil (melting point 29°C), 1 part of palm fractionated oil (melting point 21°C), 0.08 part of polyglycerin unsaturated fatty acid ester, 0.05 part of gellan gum and 76.1 parts of water. Evaluation was performed according to the same manner as that of Example 1.

The results were summarized in Table 3.

[0041]

Example 9

A whippable oil-in-water emulsion of Example 9 was obtained according to the formulation and method of Example 1 except that 12 parts of hardened coconuts oil, 1 part of rapeseed hardened oil (melting point 17°C), 0.10 part of polyglycerin unsaturated fatty acid ester, 0.05 part of guar gum and 81.1 parts of water were changed to 22 parts of palm kernel oil (melting point 29°C), 1 part of palm fractionated oil (melting point 21°C), 0.05 part of polyglycerin unsaturated fatty acid ester, 0.05 part of gellan gum and 71.1 parts of water. Evaluation was performed according to the same manner as that of Example 1. The results were summarized in Table 3.

[0042]

Formulations and the results of Example 7 to Example 9 were summarized in Table 3.

[Table 3]

(MP melting point, IN iodine number)	Example 7	Example 8	Example 9
Hardened palm kernel oil (MP 33°C)	-	-	-
Palm kernel oil (MP 29°C)	12	17	22
Palm fractionated hardened oil (MP 45°C, IN 36)	-	-	-
Rapeseed hardened oil (MP 62°C, IN 1.0 or less)	-	-	-
Palm kernel fractionated hardened oil (MP 43°C, IN 1.0 or less)	2	2	2
Hardened palm kernel oil (MP 42°C, IN 1.0 or less)	-	-	-
Palm fractionated oil (MP 21°C)	1	1	1
Rapeseed hardened oil (MP 17°C)	-	-	-
Lecithin	0.25	0.25	0.25
Polyglycerin unsaturated fatty acid ester	0.10	0.08	0.05
Defatted milk powder	3	3	3
Dextrin	-	-	-
Starch syrup	-	-	-
Sorbitol	-	-	-
Sucrose saturated fatty acid ester	0.12	0.12	0.12
Polyglycerin saturated fatty acid ester	0.05	0.05	0.05
Sodium hexametaphosphate	0.20	0.20	0.20
Sodium bicarbonate	0.02	0.02	0.02
Xanthan gum	0.05	0.05	0.05
Guar gum	-	-	-
Tamarind seed gum	-	-	-
Carrageenan	-	-	-
Gellan gum	0.05	0.05	0.05
Milk flavor	0.10	0.10	0.10
Water	81.1	76.1	71.1
Oil-and-fat component (wt%)	15	20	25
Lauric oil-and-fat (wt%)	14	19	24
Lauric oil-and-fat/Oil-and-fat component (wt%)	93	95	96
Solid state oil-and-fat (wt%)	2	2	2
Total solid component (wt%)	19	24	29
Oil-and-fat component/Total solid component	0.8	0.8	0.9
SFC 10°C	72	72	72
SFC 20°C	47	46	46
SFC 25°C	24	23	22
SFC 30°C	6	4	3
Viscosity (cp)	350	270	320
Plasticization test	5 min. or longer	5 min. or longer	5 min. or longer
Average particle diameter (μm)	1.4	1.4	1.5
Whipping time	3 min. 10 sec.	2 min. 55 sec.	2 min. 50 sec.
Overrun (%)	100	95	90
Shape retainability	B	A	A
Water separation	B	B	A
Taste	4	4	4
Meltability in the mouth	5	5	5

[0043]

Example 10

A whippable oil-in-water emulsion of Example 10 was obtained according to the formulation and method of Example 1 except that 0.10 part of polyglycerin unsaturated fatty acid ester, 3 parts of defatted milk powder, 0.05 part of xanthan gum, 0.05 part of guar gum and 81.1 parts of water were changed to 0.08 part of polyglycerin unsaturated fatty acid ester, 8 parts of defatted milk powder, 0.03 part of xanthan gum, 0.03 part of guar gum, 0.02 part of tamarind seed gum, 0.02 part of carrageenan and 76.1 parts of water. Evaluation was performed according to the same manner as that of Example 1. The results were summarized in Table 4.

[0044]

Example 11

A whippable oil-in-water emulsion of Example 11 was obtained according to the formulation and method of Example 1 except that 12 parts of hardened coconuts oil, 0.10 part of polyglycerin unsaturated fatty acid ester, 3 parts of defatted milk powder, 0.05 part of xanthan gum, 0.05 part of guar gum and 81.1 parts of water were changed to 17 parts of hardened coconuts oil, 0.06 part of polyglycerin unsaturated fatty acid ester, 8 parts of defatted milk powder, 0.03 part of xanthan gum, 0.03 part of guar gum, 0.02 part of tamarind seed gum, 0.02 part of carrageenan

and 71.1 parts of water. Evaluation was performed according to the same manner as that of Example 1. The results were summarized in Table 4.

[0045]

5 Example 12

A whippable oil-in-water emulsion of Example 12 was obtained according to the formulation and method of Example 1 except that 12 parts of hardened coconuts oil, 0.10 part of polyglycerin unsaturated fatty acid ester, 3 parts of
10 defatted milk powder, 0.05 part of xanthan gum, 0.05 part of guar gum and 81.1 parts of water were changed to 22 parts of hardened coconuts oil, 0.03 part of polyglycerin unsaturated fatty acid ester, 8 parts of defatted milk powder, 0.03 part of xanthan gum, 0.03 part of guar gum,
15 0.02 part of tamarind seed gum, 0.02 part of carrageenan and 66.1 parts of water. Evaluation was performed according to the same manner as that of Example 1. The results were summarized in Table 4.

[0046]

20 Formulations and the results of Example 10 to Example 12 were summarized in Table 4.

[Table 4]

(MP melting point, IN iodine number)	Example 10	Example 11	Example 12
Hardened palm kernel oil (MP 33°C)	12	17	22
Palm kernel oil (MP 29°C)	-	-	-
Palm fractionated hardened oil (MP 45°C, IN 36)	-	-	-
Rapeseed hardened oil (MP 62°C, IN 1.0 or less)	-	-	-
Palm kernel fractionated hardened oil (MP 43°C, IN 1.0 or less)	-	-	-
Hardened palm kernel oil (MP 42°C, IN 1.0 or less)	2	2	2
Palm fractionated oil (MP 21°C)	-	-	-
Rapeseed hardened oil (MP 17°C)	1	1	1
Lecithin	0.25	0.25	0.25
Polyglycerin unsaturated fatty acid ester	0.08	0.06	0.03
Defatted milk powder	8	8	8
Dextrin	-	-	-
Starch syrup	-	-	-
Sorbitol	-	-	-
Sucrose saturated fatty acid ester	0.12	0.12	0.12
Polyglycerin saturated fatty acid ester	0.05	0.05	0.05
Sodium hexametaphosphate	0.20	0.20	0.20
Sodium bicarbonate	0.02	0.02	0.02
Xanthan gum	0.03	0.03	0.03
Guar gum	0.03	0.03	0.03
Tamarind seed gum	0.02	0.02	0.02
Carrageenan	0.02	0.02	0.02
Gellan gum	-	-	-
Milk flavor	0.10	0.10	0.10
Water	76.1	71.1	66.1
Oil-and-fat component (wt%)	15	20	25
Lauric oil-and-fat (wt%)	14	19	24
Lauric oil-and-fat/Oil-and-fat component (wt%)	93	95	96
Solid state oil-and-fat (wt%)	2	2	2
Total solid component (wt%)	24	29	34
Oil-and-fat component/Total solid component	0.6	0.7	0.7
SFC 10°C	85	86	87
SFC 20°C	60	60	60
SFC 25°C	28	27	26
SFC 30°C	10	9	9
Viscosity (cp)	400	360	390
Plasticization test	5 min. or longer	5 min. or longer	5 min. or longer
Average particle diameter (μm)	1.4	1.5	1.5
Whipping time	3 min. 10 sec.	2 min. 55 sec.	2 min. 50 sec.
Overrun (%)	90	95	95
Shape retainability	A	A	A
Water separation	B	A	A
Taste	5	5	5
Meltability in the mouth	5	5	4

[0047]

Example 13

A whippable oil-in-water emulsion of Example 13 was obtained according to the formulation and method of Example 1 except that 12 parts of hardened coconuts oil (melting point 33°C), 2 parts of hardened palm kernel oil (melting point 42°C, iodine number 1.0 or less), 0.10 part of polyglycerin unsaturated fatty acid ester and 81.1 parts of water were changed to 18 parts of hardened coconuts oil (melting point 33°C), 1 part of palm fractionated hardened oil (melting point 45°C, iodine number 36), 0.08 part of polyglycerin unsaturated fatty acid ester and 76.1 parts of water. Evaluation was performed according to the same manner as that of Example 1. The results were summarized in Table 5.

[0048]

Example 14

A whippable oil-in-water emulsion of Example 14 was obtained according to the formulation and method of Example 1 except that 12 parts of hardened coconuts oil (melting point 33°C), 2 parts of hardened palm kernel oil (melting point 42°C, iodine number 1.0 or less), 0.10 part of polyglycerin unsaturated fatty acid ester and 81.1 parts of water were changed to 15 parts of hardened coconuts oil (melting point 33°C), 4 parts of palm fractionated hardened

oil (melting point 45°C, iodine number 36), 0.08 part of polyglycerin unsaturated fatty acid ester and 76.1 parts of water. Evaluation was performed according to the same manner as that of Example 1. The results were summarized in Table 5.

[0049]

Example 15

A whippable oil-in-water emulsion of Example 15 was obtained according to the formulation and method of Example 1 except that 12 parts of hardened coconuts oil (melting point 33°C), 2 parts of hardened palm kernel oil (melting point 42°C, iodine number 1.0 or less), 0.10 part of polyglycerin unsaturated fatty acid ester and 81.1 parts of water were changed to 13 parts of hardened coconuts oil (melting point 33°C), 6 parts of palm fractionated hardened oil (melting point 45°C, iodine number 36), 0.08 part of polyglycerin unsaturated fatty acid ester and 76.1 parts of water. Evaluation was performed according to the same manner as that of Example 1. The results were summarized in Table 5.

[0050]

Formulations and the results of Example 13 to Example 15 were summarized in Table 5.

[Table 5]

(MP melting point, IN iodine number)	Example 13	Example 14	Example 15
Hardened palm kernel oil (MP 33°C)	18	15	13
Palm kernel oil (MP 29°C)	-	-	-
Palm fractionated hardened oil (MP 45°C, IN 36)	1	4	6
Rapeseed hardened oil (MP 62°C, IN 1.0 or less)	-	-	-
Palm kernel fractionated hardened oil (MP 43°C, IN 1.0 or less)	-	-	-
Hardened palm kernel oil (MP 42°C, IN 1.0 or less)	-	-	-
Palm fractionated oil (MP 21°C)	-	-	-
Rapeseed hardened oil (MP 17°C)	1	1	1
Lecithin	0.25	0.25	0.25
Polyglycerin unsaturated fatty acid ester	0.08	0.08	0.08
Defatted milk powder	3	3	3
Dextrin	-	-	-
Starch syrup	-	-	-
Sorbitol	-	-	-
Sucrose saturated fatty acid ester	0.12	0.12	0.12
Polyglycerin saturated fatty acid ester	0.05	0.05	0.05
Sodium hexametaphosphate	0.20	0.20	0.20
Sodium bicarbonate	0.02	0.02	0.02
Xanthan gum	0.05	0.05	0.05
Guar gum	0.05	0.05	0.05
Tamarind seed gum	-	-	-
Carrageenan	-	-	-
Gellan gum	-	-	-
Milk flavor	0.10	0.10	0.10
Water	76.1	76.1	76.1
Oil-and-fat component (wt%)	20	20	20
Lauric oil-and-fat (wt%)	18	15	13
Lauric oil-and-fat/Oil-and-fat component (wt%)	90	75	65
Solid state oil-and-fat (wt%)	1	4	6
Total solid component (wt%)	24	24	24
Oil-and-fat component/Total solid component	0.8	0.8	0.8
SFC 10°C	86	86	86
SFC 20°C	58	61	63
SFC 25°C	24	30	35
SFC 30°C	8	15	19
Viscosity (cp)	305	295	315
Plasticization test	5 min. or longer	5 min. or longer	5 min. or longer
Average particle diameter (μm)	1.3	1.5	1.4
Whipping time	3 min. 30 sec.	3 min. 15 sec.	3 min. 20 sec.
Overrun (%)	105	95	100
Shape retainability	A	A	A
Water separation	A	B	B
Taste	4	4	4
Meltability in the mouth	5	3	2

[0051]

Example 16

A whippable oil-in-water emulsion of Example 16 was obtained according to the formulation and method of Example 1 except that 12 parts of hardened coconuts oil (melting point 33°C), 0.10 part of polyglycerin unsaturated fatty acid ester and 81.1 parts of water were changed to 17 parts of hardened coconuts oil (melting point 33°C), 0.08 part of polyglycerin unsaturated fatty acid ester, 10 parts of dextrin, 5 parts of starch syrup (solid component 66%) and 61.1 parts of water. Evaluation was performed according to the same manner as that of Example 1. The results were summarized in Table 6.

[0052]

Example 17

A whippable oil-in-water emulsion of Example 17 was obtained according to the formulation and method of Example 1 except that 12 parts of hardened coconuts oil (melting point 33°C), 2 parts of hardened palm kernel oil (melting point 42°C, iodine number 1.0 or less), 1 part of rapeseed hardened oil (melting point 17°C), 0.10 part of polyglycerin unsaturated fatty acid ester and 81.1 parts of water were changed to 26 parts of hardened coconuts oil (melting point 33°C), 6 parts of palm fractionated hardened oil (melting point 45°C, iodine number 36), 0.08 part of

polyglycerin unsaturated fatty acid ester and 59.1 parts of water. Evaluation was performed according to the same manner as that of Example 1. The results were summarized in Table 6.

5 [0053]

Formulations and the results of Examples 16 and 17 were summarized in Table 6.

[Table 6]

(MP melting point, IN iodine number)	Example 16	Example 17
Hardened palm kernel oil (MP 33°C)	17	26
Palm kernel oil (MP 29°C)	-	-
Palm fractionated hardened oil (MP 45°C, IN 36)	-	-
Rapeseed hardened oil (MP 62°C, IN 1.0 or less)	-	-
Palm kernel fractionated hardened oil (MP 43°C, IN 1.0 or less)	-	-
Hardened palm kernel oil (MP 42°C, IN 1.0 or less)	2	5
Palm fractionated oil (MP 21°C)	-	-
Rapeseed hardened oil (MP 17°C)	1	6
Lecithin	0.25	0.25
Polyglycerin unsaturated fatty acid ester	0.08	0.08
Defatted milk powder	3	3
Dextrin	10	-
Starch syrup	5	-
Sorbitol	-	-
Sucrose saturated fatty acid ester	0.12	0.12
Polyglycerin saturated fatty acid ester	0.05	0.05
Sodium hexametaphosphate	0.20	0.20
Sodium bicarbonate	0.02	0.02
Xanthan gum	0.05	0.05
Guar gum	0.05	0.05
Tamarind seed gum	-	-
Carrageenan	-	-
Gellan gum	-	-
Milk flavor	0.10	0.10
Water	61.1	59.1
Oil-and-fat component (wt%)	20	37
Lauric oil-and-fat (wt%)	19	31
Lauric oil-and-fat/Oil-and-fat component (wt%)	95	84
Solid state oil-and-fat (wt%)	2	5
Total solid component (wt%)	37	41
Oil-and-fat component/Total solid component	0.5	0.9
SFC 10°C	86	77
SFC 20°C	60	55
SFC 25°C	27	26
SFC 30°C	9	10
Viscosity (cp)	450	395
Plasticization test	5 min. or longer	5 min. or longer
Average particle diameter (μm)	1.4	1.8
Whipping time	2 min. 45 sec.	2 min. 10 sec.
Overrun (%)	90	95
Shape retainability	A	A
Water separation	A	A
Taste	3	3
Meltability in the mouth	4	3

[0054]

Comparative Example 1

A whippable oil-in-water emulsion of Comparative Example 1 was obtained according to the formulation and method of Example 1 except that 12 parts of hardened coconuts oil (melting point 33°C), 2 parts of hardened palm kernel oil (melting point 42°C, iodine number 1.0 or less), 0.10 part of polyglycerin unsaturated fatty acid ester and 81.1 parts of water were changed to 19 parts of hardened coconuts oil (melting point 33°C), no palm fractionated hardened oil (melting point 45°C, iodine number 36), 0.08 part of polyglycerin unsaturated fatty acid ester and 76.1 parts of water. Evaluation was performed according to the same manner as that of Example 1. The results were summarized in Table 7.

[0055]

Comparative Example 2

A whippable oil-in-water emulsion of Comparative Example 2 was obtained according to the formulation and method of Example 1 except that 12 parts of hardened coconuts oil (melting point 33°C), 0.10 part of polyglycerin unsaturated fatty acid ester and 81.1 parts of water were changed to 6 parts of hardened coconuts oil (melting point 33°C), 0.08 part of polyglycerin unsaturated fatty acid ester and 87.1 parts of water. Evaluation was

performed according to the same manner as that of Example 1.
The results were summarized in Table 7.

[0056]

Comparative Example 3

5 A whippable oil-in-water emulsion of Comparative
Example 3 was obtained according to the formulation and
method of Example 1 except that 12 parts of hardened
coconuts oil (melting point 33°C), 1 part of rapeseed
hardened oil (melting point 17°C), 0.10 part of
10 polyglycerin unsaturated fatty acid ester and 81.1 parts of
water were changed to 35 parts of hardened coconuts oil
(melting point 33°C), 5 parts of rapeseed hardened oil
(melting point 17°C), 0.01 part of polyglycerin unsaturated
fatty acid ester and 54.2 parts of water. Evaluation was
15 performed according to the same manner as that of Example 1.
The results were summarized in Table 7.

[0057]

Comparative Example 4

20 A whippable oil-in-water emulsion of Comparative
Example 4 was obtained according to the formulation and
method of Example 1 except that 12 parts of hardened
coconuts oil (melting point 33°C), 1 part of rapeseed
hardened oil (melting point 17°C), 0.10 part of
polyglycerin unsaturated fatty acid ester and 81.1 parts of
25 water were changed to 35 parts of hardened coconuts oil

(melting point 33°C), 8 parts of rapeseed hardened oil (melting point 17°C), 0.01 part of polyglycerin unsaturated fatty acid ester and 51.2 parts of water. Evaluation was performed according to the same manner as that of Example 1.

5 The results were summarized in Table 7.

[0058]

Formulations and the results of Comparative Example 1 to Comparative Example 4 were summarized in Table 7.

[Table 7]

(MP melting point, IN iodine number)	Comparative Example 1	Comparative Example 2	Comparative Example 3	Comparative Example 4
Hardened palm kernel oil (MP 33°C)	19	6	35	35
Palm kernel oil (MP 29°C)	-	-	-	-
Palm fractionated hardened oil (MP 45°C, IN 36)	-	-	-	-
Rapeseed hardened oil (MP 62°C, IN 1.0 or less)	-	-	-	-
Palm kernel fractionated hardened oil (MP 43°C, IN 1.0 or less)	-	-	-	-
Hardened palm kernel oil (MP 42°C, IN 1.0 or less)	-	2	2	5
Palm fractionated oil (MP 21°C)	-	-	-	-
Rapeseed hardened oil (MP 17°C)	1	1	5	8
Lecithin	0.25	0.25	0.25	0.25
Polyglycerin unsaturated fatty acid ester	0.08	0.08	0.01	0.01
Defatted milk powder	3	3	3	3
Dextrin	-	-	-	-
Starch syrup	-	-	-	-
Sorbitol	-	-	-	-
Sucrose saturated fatty acid ester	0.12	0.12	0.12	0.12
Polyglycerin saturated fatty acid ester	0.05	0.05	0.05	0.05
Sodium hexametaphosphate	0.20	0.20	0.20	0.20
Sodium bicarbonate	0.02	0.02	0.02	0.02
Xanthan gum	0.05	0.05	0.05	0.05
Guar gum	0.05	0.05	0.05	0.05
Tamarind seed gum	-	-	-	-
Carrageenan	-	-	-	-
Gellan gum	-	-	-	-
Milk flavor	0.10	0.10	0.10	0.10
Water	76.1	87.1	54.2	51.2
Oil-and-fat component (wt%)	20	9	42	45
Lauric oil-and-fat (wt%)	19	8	37	37
Lauric oil-and-fat/Oil-and-fat component (wt%)	95	89	88	82
Solid state oil-and-fat (wt%)	0	2	2	2
Total solid component (wt%)	24	13	46	49
Oil-and-fat component/Total solid component	0.8	0.7	0.9	0.9
SFC 10°C	86	82	80	75
SFC 20°C	57	60	55	51
SFC 25°C	22	31	22	21
SFC 30°C	6	13	7	7
Viscosity (cp)	260	205	320	335
Plasticization test	5 min. or longer	5 min. or longer	2 min. 30 sec.	1 min. 20 sec.
Average particle diameter (μm)	1.4	1.3	1.8	1.9
Whipping time	5 min. or longer	5 min. or longer	2 min. 05 sec.	1 min. 55 sec.
Overrun (%)	-	-	85	90
Shape retainability	-	-	A	A
Water separation	-	-	A	A
Taste	-	-	3	3
Meltability in the mouth	-	-	2	2

[0059]

Comparative Example 5

A whippable oil-in-water emulsion of Comparative Example 5 was obtained according to the formulation and method of Example 1 except that 12 parts of hardened coconuts oil (melting point 33°C), 0.10 part of polyglycerin unsaturated fatty acid ester and 81.1 parts of water were changed to 17 parts of hardened coconuts oil (melting point 33°C), 0.08 part of polyglycerin unsaturated fatty acid ester, 10 parts of starch syrup (solid component 66%), 25 parts of sorbitol (solid component 70%) and 41.1 parts of water. Evaluation was performed according to the same manner as that of Example 1. The results were summarized in Table 8.

[0060]

Comparative Example 6

A whippable oil-in-water emulsion of Comparative Example 6 was obtained according to the formulation and method of Example 1 except that 12 parts of hardened coconuts oil (melting point 33°C), 0.10 part of polyglycerin unsaturated fatty acid ester and 81.1 parts of water were changed to 17 parts of hardened coconuts oil (melting point 33°C), 0.08 part of polyglycerin unsaturated fatty acid ester, 10 parts of starch syrup (solid component 66%), 35 parts of sorbitol (solid component 70%) and 31.1

parts of water. Evaluation was performed according to the same manner as that of Example 1. The results were summarized in Table 8.

[0061]

5 Comparative Example 7

A whippable oil-in-water emulsion of Comparative Example 7 was obtained according to the formulation and method of Example 1 except that 12 parts of hardened coconuts oil (melting point 33°C), 0.10 part of
10 polyglycerin unsaturated fatty acid ester and 81.1 parts of water were changed to 17 parts of hardened coconuts oil (melting point 33°C), 0.08 part of polyglycerin unsaturated fatty acid ester, 10 parts of starch syrup (solid component 66%), 45 parts of sorbitol (solid component 70%) and 21.1
15 parts of water. Evaluation was performed according to the same manner as that of Example 1. The results were summarized in Table 8.

[0062]

Comparative Example 8

20 A whippable oil-in-water emulsion of Comparative Example 8 was obtained according to the formulation and method of Example 1 except that 12 parts of hardened coconuts oil (melting point 33°C), 0.10 part of
polyglycerin unsaturated fatty acid ester and 81.1 parts of
25 water were changed to 27 parts of hardened coconuts oil

(melting point 33°C), 0.08 part of polyglycerin unsaturated fatty acid ester, 10 parts of starch syrup (solid component 66%), 25 parts of sorbitol (solid component 70%) and 31.1 parts of water. Evaluation was performed according to the same manner as that of Example 1. The results were summarized in Table 8.

[0063]

Formulations and the results of Comparative Example 5 to Comparative Example 8 were summarized in Table 8.

[Table 8]

(MP melting point, IN iodine number)	Comparative Example 5	Comparative Example 6	Comparative Example 7	Comparative Example 8
Hardened palm kernel oil (MP 33°C)	17	17	17	27
Palm kernel oil (MP 29°C)	-	-	-	-
Palm fractionated hardened oil (MP 45°C, IN 36)	-	-	-	-
Rapeseed hardened oil (MP 62°C, IN 1.0 or less)	-	-	-	-
Palm kernel fractionated hardened oil (MP 43°C, IN 1.0 or less)	-	-	-	-
Hardened palm kernel oil (MP 42°C, IN 1.0 or less)	2	2	2	2
Palm fractionated oil (MP 21°C)	-	-	-	-
Rapeseed hardened oil (MP 17°C)	1	1	1	1
Lecithin	0.25	0.25	0.25	0.25
Polyglycerin unsaturated fatty acid ester	0.08	0.08	0.08	0.08
Defatted milk powder	3	3	3	3
Dextrin	10	10	10	10
Starch syrup	25	35	45	25
Sorbitol	-	-	-	-
Sucrose saturated fatty acid ester	0.12	0.12	0.12	0.12
Polyglycerin saturated fatty acid ester	0.05	0.05	0.05	0.05
Sodium hexametaphosphate	0.20	0.20	0.20	0.20
Sodium bicarbonate	0.02	0.02	0.02	0.02
Xanthan gum	0.05	0.05	0.05	0.05
Guar gum	0.05	0.05	0.05	0.05
Tamarind seed gum	-	-	-	-
Carrageenan	-	-	-	-
Gellan gum	-	-	-	-
Milk flavor	0.10	0.10	0.10	0.10
Water	41.1	31.1	21.1	31.1
Oil-and-fat component (wt%)	20	20	20	30
Lauric oil-and-fat (wt%)	19	19	19	29
Lauric oil-and-fat/Oil-and-fat component (wt%)	95	95	95	97
Solid state oil-and-fat (wt%)	2	2	2	2
Total solid component (wt%)	48	55	62	58
Oil-and-fat component/Total solid component	0.4	0.4	0.3	0.5
SFC 10°C	86	86	86	87
SFC 20°C	60	60	60	60
SFC 25°C	27	27	27	25
SFC 30°C	9	9	9	8
Viscosity (cp)	520	700	950	720
Plasticization test	5 min. or longer	5 min. or longer	5 min. or longer	1 min. 10 sec.
Average particle diameter (μm)	0.8	0.8	0.7	1.2
Whipping time	2 min. 50 sec.	2 min. 10 sec.	2 min. 10 sec.	1 min. 50 sec.
Overrun (%)	145	145	150	80
Shape retainability	A	A	A	A
Water separation	A	A	A	A
Taste	1	1	1	2
Meltability in the mouth	2	1	1	1

[0064]

As Reference Example 1, commercially available whipped cream (trade name Topping V, manufactured by Fuji Oil Co., Ltd.) which has 45% of vegetable oil-and-fat components and 3.5% of non-fat milk solid components, corresponding to conventional whipping cream which has 40 to 47 wt% of oil-and-fat components, was evaluated in the same manner as Example 1. The results were summarized in Table 9.

[Table 9]

Topping V manufactured by Fuji Oil Co., Ltd.	Reference Example 1
Vegetable oil-and-fat component	45
Non-fat milk solid component	3.5
Oil-and-fat component (wt%)	45
Total solid component (wt%)	50.5
Oil-and-fat component/Total solid component	0.9
Viscosity (cp)	200
Plasticization test	5 min. or longer
Average particle diameter (μm)	1.8
Whipping time	2 min. 30 sec.
Overrun (%)	120
Shape retainability	A
Water separation	A
Taste	3
Meltability in the mouth	3

[0065]

Example 18

5 To 80 parts of oil-in-water emulsion of Example 2
after cooling and aging at 5°C was mixed with 20 parts of
fresh cream (trade name: Yotsuba fresh cream 47%) having
47% of milk fat components and product temperature of 5°C.
To 1 kg of the mixture was added 80 g of granulated sugar,
10 this was whipped by the aforementioned whipping method, and

overrun, shape retainability and water separation were measured according to the aforementioned method. Shape retainability of the whipped product at 15°C was good, and water separation of the whipped product was absent. Milk taste and meltability in the mouth of the whipped product were good. The formulation and results were summarized in Table 10.

[0066]

Example 19

To 50 parts of oil-in-water emulsion of Example 2 after cooling and aging at 5°C was mixed with 50 parts of fresh cream (trade name: Yotsuba fresh cream 47%) having 47% of milk fat components and product temperature of 5°C. To 1 kg of the mixture was added 80 g of granulated sugar, this was whipped by the aforementioned whipping method, and overrun, shape retainability and water separation were measured according to the aforementioned method. Shape retainability of the whipped product at 15°C was good, and water separation of the whipped product was absent. Milk taste and meltability in the mouth of the whipped product were good. The formulation and results were summarized in Table 10.

[0067]

Example 20

To 20 parts of oil-in-water emulsion of Example 2

after cooling and aging at 5°C was mixed with 80 parts of fresh cream (trade name: Yotsuba fresh cream 47%) having 47% of milk fat components and product temperature of 5°C. To 1 kg of the mixture was added 80 g of granulated sugar, this was whipped by the aforementioned whipping method, and overrun, shape retainability and water separation were measured according to the aforementioned method. Shape retainability of the whipped product at 15°C was good, and water separation of the whipped product was absent. Milk taste and meltability in the mouth of the whipped product were good. The formulation and results were summarized in Table 10.

[0068]

Formulations and the results of Example 18 to Example 20 were summarized in Table 10.

[Table 10]

			Example 18	Example 19	Example 20
Oil-in-Water emulsion of Example 2	Milk fat component (%)	0.0			
	Vegetable oil- and-fat component (%)	20.0			
	Non-fat milk solid component (%)	2.8	80	50	20
	Oil-and-fat component (%)	20.0			
	Total solid component (%)	24.0			
Fresh cream (Yotsuba Co., Ltd.)	Milk fat component (%)	47.5			
	Vegetable oil- and-fat component (%)	0.0			
	Non-fat milk solid component (%)	4.5	20	50	80
	Oil-and-fat component (%)	47.5			
	Total solid component (%)	52.0			
Oil-in-water emulsion after mixing	Milk fat component (%)		9.5	23.8	38.0
	Vegetable oil- and-fat component (%)		16.0	10.0	4.0
	Non-fat milk solid component (%)		3.1	3.7	4.2
	Oil-and-fat component (%)		25.5	33.8	42.0
	Total solid component (%)		29.6	38.0	46.4
Whipping time			2 min. 55 sec.	2 min. 20 sec.	1 min. 45 sec.
Overrun (%)			100	90	85
Shape retainability			A	A	A
Water separation			A	A	B
Taste			4	5	5
Meltability in the mouth			5	5	5

[0069]

Example 21

To 80 parts of oil-in-water emulsion of Example 2 after cooling and aging at 5°C was mixed with 20 parts of cream (manufactured by Fuji Oil Co., Ltd) having 19.0% of milk fat components and 26.0% of vegetable oil-and-fat components, and product temperature of 5°C. To 1 kg of the mixture was added 80 g of granulated sugar, this was whipped by the aforementioned whipping method, and overrun, shape retainability and water separation were measured according to the aforementioned method. Shape retainability of the whipped product at 15°C was good, and water separation of the whipped product was absent. Milk taste and meltability in the mouth of the whipped product were good. The formulation and results were summarized in Table 11.

[0070]

Example 22

To 50 parts of oil-in-water emulsion of Example 2 after cooling and aging at 5°C was mixed with 50 parts of cream (manufactured by Fuji Oil Co., Ltd) having 19.0% of milk fat components and 26.0% of vegetable oil-and-fat components, and product temperature of 5°C. To 1 kg of the mixture was added 80 g of granulated sugar, this was whipped by the aforementioned whipping method, and overrun, shape retainability and water separation were measured

according to the aforementioned method. Shape
retainability of the whipped product at 15°C was good, and
water separation of the whipped product was absent. Milk
taste and meltability in the mouth of the whipped product
5 were good. The formulation and results were summarized in
Table 11.

[0071]

Example 23

To 20 parts of oil-in-water emulsion of Example 2
10 after cooling and aging at 5°C was mixed with 80 parts of
cream (manufactured by Fuji Oil Co., Ltd) having 19.0% of
milk fat components and 26.0% of vegetable oil-and-fat
components, and product temperature of 5°C. To 1 kg of the
mixture was added 80 g of granulated sugar, this was
15 whipped by the aforementioned whipping method, and overrun,
shape retainability and water separation were measured
according to the aforementioned method. Shape
retainability of the whipped product at 15°C was good, and
water separation of the whipped product was absent. Milk
20 taste and meltability in the mouth of the whipped product
were good. The formulation and results were summarized in
Table 11.

[0072]

Formulations and the results of Example 21 to Example
25 23 were summarized in Table 11.

[Table 11]

			Example 21	Example 22	Example 23
Oil-in-Water emulsion of Example 2	Milk fat component (%)	0.0	80	50	20
	Vegetable oil- and-fat component (%)	20.0			
	Non-fat milk solid component (%)	2.8			
	Oil-and-fat component (%)	20.0			
	Total solid component (%)	24.0			
Topping 500 (Fuji Oil Co., Ltd.)	Milk fat component (%)	19.0	20	50	80
	Vegetable oil- and-fat component (%)	26.0			
	Non-fat milk solid component (%)	4.0			
	Oil-and-fat component (%)	45.0			
	Total solid component (%)	50.0			
Oil-in-water emulsion after mixing	Milk fat component (%)		3.8	9.5	15.2
	Vegetable oil- and-fat component (%)		21.2	23.0	24.8
	Non-fat milk solid component (%)		3.0	3.4	3.8
	Oil-and-fat component (%)		25.0	32.5	40.0
	Total solid component (%)		29.2	37.0	44.8
Whipping time			3 min. 05 sec.	2 min. 55 sec.	2 min. 50 sec.
Overrun (%)			100	100	100
Shape retainability			A	A	A
Water separation			A	A	A
Taste			4	4	4
Meltability in the mouth			5	5	5

[0073]

Example 24

To 80 parts of oil-in-water emulsion of Example 11 after cooling and aging at 5°C was mixed with 20 parts of fresh cream (trade name: Yotsuba fresh cream 47%) having 47% of milk fat components and product temperature of 5°C. To 1 kg of the mixture was added 80 g of granulated sugar, this was whipped by the aforementioned whipping method, and overrun, shape retainability and water separation were measured according to the aforementioned method. Shape retainability of the whipped product at 15°C was good, and water separation of the whipped product was absent. Milk taste and meltability in the mouth of the whipped product were good. The formulation and results were summarized in Table 12.

[0074]

Example 25

To 50 parts of oil-in-water emulsion of Example 11 after cooling and aging at 5°C was mixed with 50 parts of fresh cream (trade name: Yotsuba fresh cream 47%) having 47% of milk fat components and product temperature of 5°C. To 1 kg of the mixture was added 80 g of granulated sugar, this was whipped by the aforementioned whipping method, and overrun, shape retainability and water separation were measured according to the aforementioned method. Shape retainability of the whipped product at 15°C was good, and

water separation of the whipped product was absent. Milk taste and meltability in the mouth of the whipped product were good. The formulation and results were summarized in Table 12.

5 [0075]

Example 26

To 20 parts of oil-in-water emulsion of Example 11 after cooling and aging at 5°C was mixed with 80 parts of fresh cream (trade name: Yotsuba fresh cream 47%) having
10 47% of milk fat components and product temperature of 5°C. To 1 kg of the mixture was added 80 g of granulated sugar, this was whipped by the aforementioned whipping method, and overrun, shape retainability and water separation were measured according to the aforementioned method. Shape
15 retainability of the whipped product at 15°C was good, and water separation of the whipped product was absent. Milk taste and meltability in the mouth of the whipped product were good. The formulation and results were summarized in Table 12.

20 [0076]

Formulations and the results of Example 24 to Example 26 were summarized in Table 12.

[Table 12]

			Example 24	Example 25	Example 26
Oil-in-Water emulsion of Example 11	Milk fat component (%)	0.0			
	Vegetable oil- and-fat component (%)	20.0			
	Non-fat milk solid component (%)	7.6	80	50	20
	Oil-and-fat component (%)	20.0			
	Total solid component (%)	29.0			
Fresh cream (Yotsuba Co., Ltd.)	Milk fat component (%)	47.5			
	Vegetable oil- and-fat component (%)	0.0			
	Non-fat milk solid component (%)	4.5	20	50	80
	Oil-and-fat component (%)	47.5			
	Total solid component (%)	52.0			
Oil-in-water emulsion after mixing	Milk fat component (%)		9.5	23.8	38.0
	Vegetable oil- and-fat component (%)		16.0	10.0	4.0
	Non-fat milk solid component (%)		7.0	6.1	5.1
	Oil-and-fat component (%)		25.5	33.8	42.0
	Total solid component (%)		33.6	40.5	47.4
Whipping time			2 min. 50 sec.	2 min. 00 sec.	1 min. 40 sec.
Overrun (%)			95	90	80
Shape retainability			A	A	A
Water separation			A	A	A
Taste			5	5	5
Meltability in the mouth			5	5	5

[0077]

Example 27

To 80 parts of oil-in-water emulsion of Example 11 after cooling and aging at 5°C was mixed with 20 parts of cream (manufactured by Fuji Oil Co., Ltd) having 19.0% of milk fat components and 26.0% of vegetable oil-and-fat components, and product temperature of 5°C. To 1 kg of the mixture was added 80 g of granulated sugar, this was whipped by the aforementioned whipping method, and overrun, shape retainability and water separation were measured according to the aforementioned method. Shape retainability of the whipped product at 15°C was good, and water separation of the whipped product was absent. Milk taste and meltability in the mouth of the whipped product were good. The formulation and results were summarized in Table 13.

[0078]

Example 28

To 50 parts of oil-in-water emulsion of Example 11 after cooling and aging at 5°C was mixed with 50 parts of cream (manufactured by Fuji Oil Co., Ltd) having 19.0% of milk fat components and 26.0% of vegetable oil-and-fat components, and product temperature of 5°C. To 1 kg of the mixture was added 80 g of granulated sugar, this was whipped by the aforementioned whipping method, and overrun, shape retainability and water separation were measured

according to the aforementioned method. Shape retainability of the whipped product at 15°C was good, and water separation of the whipped product was absent. Milk taste and meltability in the mouth of the whipped product were good. The formulation and results were summarized in Table 13.

[0079]

Example 29

To 20 parts of oil-in-water emulsion of Example 11 after cooling and aging at 5°C was mixed with 80 parts of cream (manufactured by Fuji Oil Co., Ltd) having 19.0% of milk fat components and 26.0% of vegetable oil-and-fat components, and product temperature of 5°C. To 1 kg of the mixture was added 80 g of granulated sugar, this was whipped by the aforementioned whipping method, and overrun, shape retainability and water separation were measured according to the aforementioned method. Shape retainability of the whipped product at 15°C was good, and water separation of the whipped product was absent. Milk taste and meltability in the mouth of the whipped product were good. The formulation and results were summarized in Table 13.

[0080]

Formulations and the results of Example 27 to Example 29 were summarized in Table 13.

[Table 13]

			Example 27	Example 28	Example 29
Oil-in-Water emulsion of Example 11	Milk fat component (%)	0.0	80	50	20
	Vegetable oil- and-fat component (%)	20.0			
	Non-fat milk solid component (%)	7.6			
	Oil-and-fat component (%)	20.0			
	Total solid component (%)	29.0			
Topping 500 (Fuji Oil Co., Ltd.)	Milk fat component (%)	19.0	20	50	80
	Vegetable oil- and-fat component (%)	26.0			
	Non-fat milk solid component (%)	4.0			
	Oil-and-fat component (%)	45.0			
	Total solid component (%)	50.0			
Oil-in-water emulsion after mixing	Milk fat component (%)		3.8	9.5	15.2
	Vegetable oil- and-fat component (%)		21.2	23.0	24.8
	Non-fat milk solid component (%)		6.9	5.8	4.7
	Oil-and-fat component (%)		25.0	32.5	40.0
	Total solid component (%)		33.2	39.5	45.8
Whipping time			3 min. 00 sec.	2 min. 50 sec.	2 min. 50 sec.
Overrun (%)			95	100	100
Shape retainability			A	A	A
Water separation			A	A	A
Taste			5	5	5
Meltability in the mouth			5	5	5

[0081]

Reference Example 2

To 1 kg of fresh cream (trade name: Yotsuba fresh cream 47%) having 47% of milk fat components and product temperature of 5°C was added 80 g of granulated sugar, this
5 was whipped by the aforementioned whipping method, and overrun, shape retainability and water separation were measured according to the aforementioned method. Shape retainability of the whipped product at 15°C was good, and water separation of the whipped product was absent. Milk
10 taste of the whipped product was good and meltability in the mouth of the whipped product was acceptable. The formulation and results were summarized in Table 14.

[0082]

15 Reference Example 3

To 1 kg of Topping 500 (manufactured by Fuji Oil Co., Ltd) having 19.0% of milk fat components and 26.0% of vegetable oil-and-fat components, and product temperature of 5°C was added 80 g of granulated sugar, this was whipped
20 by the aforementioned whipping method, and overrun, shape retainability and water separation were measured according to the aforementioned method. Shape retainability of the whipped product at 15°C was good, and water separation of the whipped product was absent. Milk taste of the whipped
25 product was good and meltability in the mouth of the

whipped product was acceptable. The formulation and results were summarized in Table 14.

[0083]

Formulations and the results of Reference Examples 2
5 and 3 were summarized in Table 14.

[Table 14]

		Reference Example 2
Fresh cream (Yotsuba Co., Ltd.)	Milk fat component (%)	47.5
	Vegetable oil-and-fat component (%)	0.0
	Non-fat milk solid component (%)	4.5
	Oil-and-fat component (%)	47.5
	Total solid component (%)	52.0
Whipping time		1 min. 00 sec.
Overrun (%)		75
Shape retainability		B
Water separation		B
Taste		5
Meltability in the mouth		3

		Reference Example 3
Topping 500 (Fuji Oil Co., Ltd.)	Milk fat component (%)	19.0
	Vegetable oil-and-fat component (%)	26.0
	Non-fat milk solid component (%)	4.0
	Oil-and-fat component (%)	45.0
	Total solid component (%)	50.0
Whipping time		2 min. 40 sec.
Overrun (%)		100
Shape retainability		A
Water separation		A
Taste		4
Meltability in the mouth		3

Industrial Applicability

[0084]

- 5 The present invention relates to an oil-in-water emulsion with low oil-and-fat content which is 10-40 wt% of

oil-and-fat components, and more particularly, a whippable oil-in-water emulsion (whipping cream) used as a topping of a cake or the like, or used for a sandwiched whipping cream between cakes, and a whippable oil-in-water emulsion which
5 has high emulsion stability and whippability, and also which has an excellent shape retainability, an excellent meltability in the mouth, an excellent flavor and taste after whipping.

CLAIMS

1. An oil-in-water emulsion with low oil-and-fat
content comprising an oil-and-fat, protein and water, and a
5 solid state oil-and-fat with a melting point of 40 to 68°C
and an iodine number of 40 or less and an oil-and-fat which
is liquid state at 20°C, wherein the oil-in-water emulsion
has 12 to 30 wt% of oil-and-fat components, a total solid
component of the oil-in-water emulsion is 18 to 38 wt%, an
10 amount of sugar in the oil-in-water emulsion is 0.5 to 10
wt%, lauric oil-and-fat content in an oil phase of the oil-
in-water emulsion is 60 % or more, a content of the solid
state oil-and-fat with respect to the oil-in-water emulsion
is 0.5 to 5 wt%, a content of the oil-and-fat which is
15 liquid state at 20°C with respect to the oil-in-water
emulsion is 0.5 to 5 wt%, and an average particle diameter
of an oil-and-fat particle in the emulsion is in the range
from 0.8 to 2.4 μm .

20 2. The oil-in-water emulsion with low oil-and-fat
content according to claim 1, wherein the lauric oil-and-
fat is non-interesterified oil-and-fat.

3. The oil-in-water emulsion with low oil-and-fat
25 content according to claim 1, wherein an amount of the

solid state oil-and-fat in the oil phase is 2 to 25%.

4. The oil-in-water emulsion with low oil-and-fat content according to claim 1, wherein the oil-in-water emulsion has 12 to 30 wt% of oil-and-fat components, a total solid component of the oil-in-water emulsion is 18 to 38 wt%, and oil-and-fat component/total solid component is 0.3 or more.

5. The oil-in-water emulsion with low oil-and-fat content according to claim 1, wherein an amount of the oil-and-fat which is liquid state at 20°C in the oil phase is 2 to 30%.

6. The oil-in-water emulsion with low oil-and-fat content according to claim 1, wherein SFC of the oil phase is 60 to 95 % at 10°C, 35 to 70 % at 20°C, 20 to 40 % at 25°C, and 0 to 20 % at 30°C.

7. The oil-in-water emulsion with low oil-and-fat content according to any one of claims 1-6, wherein the oil-in-water emulsion is whippable.

8. The oil-in-water emulsion with low oil-and-fat content according to claim 7, wherein an overrun of the

oil-in-water emulsion is 50 to 140 %.

9. A process for producing an oil-in-water emulsion with low oil-and-fat content which comprises,
5 blending an oil-and-fat, protein and water as a raw material,
adjusting an oil-and-fat content to 12 to 30 wt%, a total solid component of the oil-in-water emulsion to 18 to 38 wt% and an amount of sugar in the oil-in-water emulsion to
10 0.5 to 10 wt%,
blending a solid state oil-and-fat with a melting point of 40 to 68°C and an iodine number of 40 or less into the oil-in-water emulsion on a blending amount of 0.5 to 5 wt% with respect to the oil-in-water emulsion,
15 blending an oil-and-fat which is liquid state at 20°C to the oil-in-water emulsion on a blending amount of 0.5 to 5 wt% with respect to the oil-in-water emulsion, and
adjusting an average particle diameter of an oil-and-fat particle in the emulsion to the range from 0.8 to 2.4 μm ,
20 wherein a lauric oil-and-fat content in an oil phase of the oil-in-water emulsion is 60 % or more.

10. An oil-in-water emulsion containing milk fat and vegetable oil-and-fat comprising the oil-in-water emulsion
25 with low oil-and-fat content according to any one of claims

1 to 6, and an emulsion containing milk fat.