

[DESCRIPTION]

[TITLE OF INVENTION]

FOAMABLE OIL-IN-WATER-TYPE EMULSION, AND METHOD FOR  
MANUFACTURING FOAMED OIL-IN-WATER-TYPE EMULSION

5 [Technical Field]

[0001]

The present invention relates to an oil-in-water-type emulsion that has emulsification stability at room temperature and can foam at refrigeration temperature to room temperature after storage at room temperature, and a method for manufacturing a  
10 foamed oil-in-water-type emulsion.

[Background Art]

[0002]

Foamable oil-in-water-type emulsions are widely used in Western confectionery, bread, and cooking ingredients to improve the appearance and flavor and increase  
15 palatability. There are three types of foamable oil-in-water-type emulsion: fresh creams separated from milk, synthetic creams made from animal and vegetable fats, and compound creams in which these two creams are mixed. The above-mentioned fresh creams have an excellent milk flavor, but have the following problems: a high price, slightly low emulsification stability during distribution and storage, easy occurrence of a  
20 plasticization phenomenon (viscosity increase) and a churning phenomenon (demulsification) during transportation, and difficulties in proper foaming due to a narrow foaming end-point range when foaming. On the other hand, compared to the fresh creams, the synthetic creams and compound creams are widely used in the above-mentioned use applications because they are cheaper and have relatively stable  
25 emulsification stability and foaming performance.

[0003]

However, even in the foamable oil-in-water-type emulsions such as synthetic creams and compound creams, an increase in viscosity or a plasticization phenomenon of an unfoamed stock solution may occur in some cases depending on distribution and storage conditions, or depending on the type and amount of fats and emulsifiers used in a foamable oil-in-water-type emulsion. In particular, in a case where a foamable oil-in-water-type emulsion is distributed at a room temperature such as 20°C to 40°C, and in a case where crystals of a fat used in the foamable oil-in-water-type emulsion are likely to be coarsened or undergo phase-transition, there are particular problems in these cases in which an increase in viscosity and the plasticization phenomenon of an unfoamed stock solution easily occur, and the commodity value of the foamable oil-in-water-type emulsion is lost.

[0004]

As a technique for solving the above-mentioned problems, various solutions have been proposed through examination of both fats and emulsifiers used in foamable oil-in-water-type emulsions.

[0005]

Patent Literature 1 relates to a foamable oil-in-water-type emulsion which consists of 3 to 50 wt% of a fat phase and 50 to 97 wt% of a water phase, in which the fat phase contains fats in which a constituent fatty acid residue contains 5 to 70 wt% of C20-24 saturated fatty acids, and the fat phase contains, as a lipophilic emulsifier, one or more kinds of glycerin fatty acid ester, sucrose fatty acid ester, sorbitan fatty acid ester, polyglycerin fatty acid ester, and propylene glycol fatty acid ester, in which a main constituent fatty acid residue is C20-24 saturated fatty acids. This foamable oil-in-water-type emulsion has characteristics that are satisfactory for mechanical

resistance, and temperature resistance depending on changes in the external environment, and whip cream obtained by foaming of the emulsion has a feature of no change in a cream structure even upon storage, but there is no mention of emulsification stability at room temperature such as 20°C to 40°C and a foaming performance at room temperature.

5 [0006]

Patent Literature 2 relates to a method for manufacturing an oil-in-water-type emulsion, the method including using 1 wt% or more of an asymmetrical triglyceride with two long chains and one short chain added with respect to a total amount of fat components when manufacturing an oil-in-water-type emulsion using a fat phase and a  
10 water phase. According to the invention of JPH06-178664A, it is possible to manufacture an oil-in-water-type emulsion in which an increase in viscosity or a plasticization phenomenon hardly occurs, and although emulsification stability at room temperature such as 20°C to 40°C is extremely excellent during manufacture or storage, or regardless of the type of fats used, the oil-in-water-type emulsion of this invention  
15 does not relate to a foamable oil-in-water-type emulsion.

[0007]

Patent Literature 3 relates to an oil-in-water-type emulsion food product which can be whipped, that is, a foamable oil-in-water-type emulsion which contains fats consisting of 80 to 90 wt% of a first fraction such as a hydrogenated palm kernel oil  
20 having an iodine value of 5 or less, and 10 to 20 wt% of a second fraction such as a high-melting point part of palm oil; an emulsifier component in which a HLB ratio of a stabilizing emulsifier to a destabilizing emulsifier is 1 to 4; and one or more sugars. According to this invention of JP2007-500516A, the foamable oil-in-water-type emulsion can be stored at an environmental temperature of 30°C to 40°C and can be  
25 whipped at 10°C to 27°C.

[Citation List]

[Patent Literature]

[0008]

[Patent Literature 1]

5 Japanese Patent Laid-Open No. H06-276978

[Patent Literature 2]

Japanese Patent Laid-Open No. H06-178664

[Patent Literature 3]

Japanese Patent Laid-Open No. 2007-500516

10 [Summary of Invention]

[Technical Problem]

[0009]

In light of the above-described related art, the inventors of the present invention provide an oil-in-water-type emulsion that has emulsification stability for storage at room temperature such as 20°C to 40°C, and that can foam, after storage at room temperature, at refrigeration temperature to room temperature such as 3°C to 30°C; and a method for manufacturing a foamed oil-in-water-type emulsion.

[Solution to Problem]

[0010]

20 As a result of intensive investigations aimed at solving the above-described problems, the inventors of the present invention have found that, in foamable oil-in-water-type emulsions containing fats, emulsifiers, saccharides, and water, a foamable oil-in-water-type emulsion containing a specific fat and a specific emulsifier has the above-mentioned target room-temperature emulsification stability and room-temperature foaming performance, and therefore have completed the present

invention.

[0011]

That is, the present invention is as follows.

(1) A foamable oil-in-water-type emulsion containing fats, emulsifiers,

5 saccharides, and water,

in which the foamable oil-in-water-type emulsion satisfies any one selected from the following i), ii), iii), and iv):

i) the fats are a fat C formed of 88 to 98 wt% of a fat A that is a laurin-based fat having a rising melting point of 35°C to 42°C, and 2 to 12 wt% of a fat B in which

10 C20-24 saturated fatty acids represent 10 to 75 wt% of all constituent fatty acids,

ii) the fats are the fat A and contain, as lipophilic emulsifiers, one or more kinds of glycerin fatty acid ester, sucrose fatty acid ester, sorbitan fatty acid ester, polyglycerin fatty acid ester, and propylene glycol fatty acid ester, in which a main constituent fatty acid residue is C20-24 saturated fatty acids,

15 iii) the fats are the fat C and further contain the lipophilic emulsifiers described in ii), and

iv) the fats are a fat D formed of more than 98 wt% and less than 100 wt% of the fat A, and more than 0 wt% and less than 2 wt% of the fat B; and further contain the lipophilic emulsifiers described in ii).

20 (2) The foamable oil-in-water-type emulsion according to (1), in which the fat A is one or more kinds selected from fractionated oil, hydrogenated oil, and transesterified oil of palm kernel oil, palm oil, and babassu oil.

(3) The foamable oil-in-water-type emulsion according to (1), in which the fat B is an fully hydrogenated rapeseed oil in which C22 saturated fatty acids represent 20 to  
25 60 wt% of all constituent fatty acids.

(4) The foamable oil-in-water-type emulsion according to (1), in which a content of the lipophilic emulsifiers according to (1) is 0.1 to 3 wt% with respect to the foamable oil-in-water-type emulsion.

5 (5) The foamable oil-in-water-type emulsion according to (1), further containing a stabilizing emulsifier and a demulsifier as emulsifiers, in which, in a case where a content of the stabilizing emulsifier is X wt% and a content of the demulsifier is Y wt%, a value of (X/Y) is 10 or more, and a total amount of X and Y is 0.1 to 3 wt%.

(6) The foamable oil-in-water-type emulsion according to (1), in which, as the saccharides, 5 to 25 wt% of one or more kinds selected from starch decomposition  
10 products, oligosaccharides, disaccharides, monosaccharides, and sugar alcohols are contained.

(7) The foamable oil-in-water-type emulsion according to (1), in which a fat content is 10 to 30 wt%.

(8) The foamable oil-in-water-type emulsion according to (1), in which a total  
15 solid content is 30 to 50 wt%.

(9) A method for manufacturing a foamed oil-in-water-type emulsion, the method including storing the foamable oil-in-water-type emulsion according to (1) at 20°C to 40°C, thereafter adjusting the temperature to 3°C to 30°C, and thereafter allowing the foamable oil-in-water-type emulsion to foam.

20 [Advantageous Effects of Invention]

[0012]

According to the present invention, it is possible to provide an oil-in-water-type emulsion that has emulsification stability for storage at room temperature such as 20°C to 40°C, and that can foam, after storage at room temperature, at refrigeration temperature  
25 to room temperature such as 3°C to 30°C; and a method for manufacturing a foamed

oil-in-water-type emulsion. According to the present invention, it is possible to provide a foamable oil-in-water-type emulsion which can be provided to markets in which a refrigeration or frozen distribution network is not established; which contributes to energy reduction, as this emulsion does not require refrigeration or frozen storage; and  
5 which contributes to reduction of food waste due to a plasticization phenomenon (viscosity increase) and a churning phenomenon (demulsification) during transportation.

[Description of Embodiments]

[0013]

A foamable oil-in-water-type emulsion of the present invention is an  
10 oil-in-water-type emulsion containing fats, emulsifiers, saccharides, and water, and is an emulsion having room-temperature emulsion stability in a fluid state before foaming. Furthermore, the present invention relates to a foamable oil-in-water-type emulsion having foamability that enables foaming at room temperature, and excellent shape retainability of a foamed oil-in-water-type emulsion after whipping. The foamable  
15 oil-in-water-type emulsion will be sometimes referred to as “whipping cream.” This is a foamed oil-in-water-type emulsion that is agitated so that air is entrapped using a foaming device or a dedicated mixer, and is commonly called “whipped cream” or “whip cream” when exhibiting a foaming state.

[0014]

20 Examples of fats that can be used in the foamable oil-in-water-type emulsion of the present invention include a fat A that is a laurin-based fat having a rising melting point of 35°C to 42°C, and a fat C that is a mixed oil formed of 88 to 98 wt% of the fat A and 2 to 12 wt% of a fat B in which C20-24 saturated fatty acids represent 10 to 75 wt% of all constituent fatty acids. As one aspect of the present invention, in a case where  
25 only the fat A is used as a fat, it is necessary to include, as lipophilic emulsifiers, one or

more kinds of glycerin fatty acid ester, sucrose fatty acid ester, sorbitan fatty acid ester, polyglycerin fatty acid ester, and propylene glycol fatty acid ester, in which a main constituent fatty acid residue is C20-24 saturated fatty acids. As another aspect, in a case where the fat C is used as a fat, the lipophilic emulsifier may be contained or may not be contained. In addition, in a case of using, as a fat, a fat D formed of more than 98 wt% and less than 100 wt% of the fat A, and more than 0 wt% and less than 2 wt% of the fat B, it is necessary to include the lipophilic emulsifiers, but in this case, an amount of the lipophilic emulsifiers blended in may be reduced as compared to the case where only the fat A is used as a fat.

10 [0015]

As the fat A that is a laurin-based fat having a rising melting point of 35°C to 42°C in the present invention, one or more kinds selected from fractionated oil, hydrogenated oil, and transesterified oil of palm kernel oil, palm oil, and babassu oil are preferable. A rising melting point of the fat A is more preferably 35°C to 40°C. When the rising melting point is less than 35°C, a room-temperature foaming performance of the foamable oil-in-water-type emulsion tends to decrease, and heat-resistant shape retainability of a foamed oil-in-water-type emulsion tends to decrease. On the other hand, a rising melting point exceeding 42°C is not preferable because melting sensation in the mouth of a foamed oil-in-water-type emulsion is diminished.

20 [0016]

A content of C20-24 saturated fatty acids in all constituent fatty acids of the fat B used in the present invention is 10 to 75 wt%, is more preferably 20 to 70 wt%, and is most preferably 30 to 60 wt%. A case in which a content of C20-24 saturated fatty acids is less than 10 wt% is not preferable because then it is necessary to increase an amount thereof added to the foamable oil-in-water-type emulsion, and melting sensation

in the mouth of a foamed oil-in-water-type emulsion is diminished. Examples of the fat B include a fully hydrogenated high erucic acid rapeseed oil and a fully hydrogenated fish oil in which C22 saturated fatty acids represent 20 to 60 wt% of all constituent fatty acids, and one or more kinds thereof can be used. In particular, use of the fully hydrogenated high erucic acid rapeseed oil having 40 to 60 wt% of C22 saturated fatty acids is more desirable because thereby it is possible to decrease an amount of fully hydrogenated oils blended in, which have a relatively high melting point.

[0017]

In a case of adopting, to the foamable oil-in-water-type emulsion of the present invention, an aspect in which the fat C that is a mixed oil formed of 88 to 98 wt% of the fat A and 2 to 12 wt% of the fat B is used, and the lipophilic emulsifiers are not contained, the fat C is more preferably a mixed oil formed of 90 to 95 wt% of the fat A and 5 to 10 wt% of the fat B. A case in which there is less than 88 wt% of the fat A and more than 12 wt% of the fat B is not preferable because then melting sensation in the mouth of a foamed oil-in-water-type emulsion is diminished. In contrast, when there is in excess of 98 wt% of the fat A and less than 2 wt% of the fat B, the room-temperature emulsion stability and room-temperature foaming performance of the foamable oil-in-water-type emulsion tend to be lowered.

[0018]

In a case of adopting, to the foamable oil-in-water-type emulsion of the present invention, an aspect in which the fat C that is a mixed oil formed of 88 to 98 wt% of the fat A and 2 to 12 wt% of the fat B is used, and the lipophilic emulsifiers are contained, the fat C is more preferably a mixed oil formed of 92 to 98 wt% of the fat A and 2 to 8 wt% of the fat B. By incorporating the lipophilic emulsifiers, it is possible to decrease an amount of fats having a relatively high melting point blended in, and thereby to

improve melting sensation in the mouth of a foamed oil-in-water-type emulsion. In addition, in a case of using the fat D as a fat, since it is possible to decrease an amount of the lipophilic emulsifiers blended in, it is also possible to improve melting sensation in the mouth of a foamed oil-in-water-type emulsion.

5 [0019]

The lipophilic emulsifiers used in the foamable oil-in-water-type emulsion of the present invention are one or more kinds of glycerin fatty acid ester, sucrose fatty acid ester, sorbitan fatty acid ester, polyglycerin fatty acid ester, and propylene glycol fatty acid ester, in which a main constituent fatty acid residue is C20-24 saturated fatty acids.

10 When using them, an amount of these lipophilic emulsifiers blended in is preferably 0.1 to 3 wt%, is more preferably 0.1 to 2 wt%, and is most preferably 0.1 to 1 wt% with respect to the foamable oil-in-water-type emulsion.

[0020]

In a case where a fat used in the foamable oil-in-water-type emulsion is the fat A, and when an amount of the lipophilic emulsifiers blended in is less than 0.1 wt%, the room-temperature emulsion stability and room-temperature foaming performance tend to be lowered. On the other hand, an amount exceeding 3 wt% is not preferable because then an increase in viscosity of the foamable oil-in-water-type emulsion becomes noticeable, and melting sensation in the mouth of a foamed oil-in-water-type emulsion is diminished.

20 [0021]

In a case where a fat used in the foamable oil-in-water-type emulsion is the fat C, an amount of the lipophilic emulsifiers blended in is preferably 0.1 to 1 wt% and is most preferably 0.1 to 0.5 wt%. According to an effect of using the fat C and the lipophilic emulsifiers in combination, it is possible to set an amount of the lipophilic emulsifiers

blended in to a relatively low amount, and to improve melting sensation in the mouth of a foamed oil-in-water-type emulsion.

[0022]

In a case where a fat used in the foamable oil-in-water-type emulsion is the fat D,  
5 an amount of the lipophilic emulsifiers blended in is preferably 0.1 to 2 wt% and is most preferably 0.1 to 0.5 wt%. According to an effect of using the fat D and the lipophilic emulsifiers in combination, it is also possible to set an amount of the lipophilic emulsifier blended in to a relatively low amount, and to improve melting sensation in the mouth of a foamed oil-in-water-type emulsion.

10 [0023]

As the C20-24 saturated fatty acids in the lipophilic emulsifiers, C20 arachidic acid or C22 behenic acid is preferable, and behenic acid is particularly preferable. A main constituent fatty acid residue means that a content of C20-24 saturated fatty acids in all constituent fatty acids is 50 wt% or more, is more preferably 60 wt% or more, and is  
15 most preferably 70 wt% or more. In addition, the lipophilic emulsifiers preferably have an HLB of 5 or less.

[0024]

To impart the room-temperature emulsion stability and room-temperature foaming performance, the foamable oil-in-water-type emulsion of the present invention  
20 preferably contains a stabilizing emulsifier and a demulsifier as emulsifiers, in which, in a case where a content of the stabilizing emulsifier is X wt% and a content of the demulsifier is Y wt%, a value of (X/Y) is preferably 10 or more, and a total amount of X and Y is preferably 0.1 to 3 wt%.

[0025]

25 The value of (X/Y) is more preferably 12 or more, and is even more preferably

14 or more. When the value of (X/Y) is less than 10, the room-temperature emulsion stability tends to be lowered. In addition, the total amount of X and Y is more preferably 0.3 to 2 wt% and is even more preferably 0.5 to 1 wt%. When the total amount of X and Y is less than 0.1 wt%, the room-temperature emulsion stability tends to be lowered. On the other hand, when it exceeds 3 wt%, melting sensation in the mouth and taste of a foamed oil-in-water-type emulsion tend to be diminished.

[0026]

The stabilizing emulsifier that can be used in the foamable oil-in-water-type emulsion of the present invention is a stabilizing emulsifier in which 95 wt% or more of all constituent fatty acids are saturated fatty acids in a lipophilic group. Examples thereof include one or more kinds of emulsifiers selected from monoglycerin saturated fatty acid ester, polyglycerin saturated fatty acid ester, sucrose saturated fatty acid ester, sorbitan saturated fatty acid ester, polyoxyethylene sorbitan saturated fatty acid ester, propylene glycol saturated fatty acid ester, and organic acid saturated fatty acid ester. Preferable examples thereof include one or more kinds of emulsifiers selected from monoglycerin saturated fatty acid ester, polyglycerin saturated fatty acid ester, sucrose saturated fatty acid ester, sorbitan saturated fatty acid ester, and polyoxyethylene sorbitan saturated fatty acid ester. More preferable examples thereof include one kinds of emulsifiers selected from sucrose saturated fatty acid esters and polyoxyethylene sorbitan saturated fatty acid esters.

[0027]

The demulsifier that can be used in the foamable oil-in-water-type emulsion of the present invention is a demulsifier in which 60 wt% or more of all constituent fatty acids are unsaturated fatty acids in a lipophilic group. Examples thereof include one or more kinds of demulsifiers selected from monoglycerin unsaturated fatty acid ester,

polyglycerin unsaturated fatty acid ester, sorbitan unsaturated fatty acid ester, polyoxyethylene sorbitan unsaturated fatty acid ester, propylene glycol unsaturated fatty acid ester, organic acid unsaturated fatty acid ester, soybean lecithin, and egg yolk lecithin. Preferable examples thereof include one or more kinds of demulsifiers selected from monoglycerin unsaturated fatty acid ester, polyglycerin unsaturated fatty acid ester, sorbitan unsaturated fatty acid ester, polyoxyethylene sorbitan unsaturated fatty acid ester, soybean lecithin, and egg yolk lecithin. More preferable examples thereof include one kinds of demulsifiers selected from polyglycerin unsaturated fatty acid ester, and soybean lecithin.

10 [0028]

The saccharides that can be used in the foamable oil-in-water-type emulsion of the present invention are one or more kinds selected from starch decomposition products, oligosaccharides, disaccharides, monosaccharides, and sugar alcohols. An amount thereof blended in with respect to the foamable oil-in-water-type emulsion is 5 to 25 wt% and is more preferably 10 to 20 wt%. When an amount of saccharides blended in is less than 5 wt%, the room-temperature emulsion stability and room-temperature foaming performance tend to be lowered. Conversely, an amount thereof exceeding 25 wt% is not preferable because a viscosity of the foamable oil-in-water-type emulsion becomes high, and the sweetness becomes too strong.

20 [0029]

Examples of the saccharides include glucose, sucrose, fructose, dextrose, trehalose, polydextrose, maltitol, erythritol, xylitol, mannitol, lactitol, sorbitol, and the like, but use of sucrose is more preferable for more natural sweetness.

[0030]

25 A fat content of the foamable oil-in-water-type emulsion of the present invention

is preferably 10 to 30 wt%, is more preferably 12 to 29 wt%, and is even more preferably 15 to 28 wt%. When the fat content is less than 10%, a time required for foaming is extended, and satisfactory shape retainability is not obtained. When the fat content exceeds 30 wt%, a texture tends to be slightly oily.

5 [0031]

A solid content of the foamable oil-in-water-type emulsion of the present invention is preferably 30 to 50 wt%. The solid content is a sum of fats and non-fat solids other than fats, and examples of non-fat solids include saccharides, polysaccharide thickeners, proteins, plant fibers, various salts, flavours, coloring agents, preservatives,  
10 and the like. When the solid content is less than 30 wt%, the room-temperature emulsion stability and room-temperature foaming performance tend to be lowered. On the other hand, when it exceeds 50 wt%, a viscosity of the foamable oil-in-water-type emulsion tends to become high, and the room-temperature emulsion stability and taste of a foamed oil-in-water-type emulsion tend to be lowered.

15 [0032]

In the present invention, it is possible to appropriately use the above-mentioned polysaccharide thickeners, proteins, plant fibers, various salts, flavours, coloring agents, and preservatives within a range not interfering with the room-temperature emulsion stability and room-temperature foaming performance of the foamable oil-in-water-type  
20 emulsion.

[0033]

As polysaccharide thickeners, it is possible to use one or more kinds selected from gellan gum, xanthan gum, locust bean gum, pullulan, guar gum, psyllium seed gum, succinoglycan, water soluble soy polysaccharide, carrageenan, tamarind seed gum, and  
25 tara gum. It is preferable to use one or more kinds of polysaccharide thickeners selected

from gellan gum, xanthan gum, pullulan, guar gum, psyllium seed gum, succinoglycan, water-soluble soybean polysaccharide, carrageenan, and tamarind seed gum.

[0034]

As proteins, any of a milk raw material containing a milk protein, and a plant  
5 raw material containing a vegetable protein can be used. Examples of milk raw materials containing a milk protein include whole milk powder, skim milk powder, butter milk powder, whey protein, caseins such as acid casein, rennet casein, sodium caseinate, calcium caseinate, or potassium caseinate, or total milk protein. Examples of plant raw materials include concentrated soy protein, isolated soy protein, pea protein, wheat  
10 protein, and the like.

[0035]

Examples of plant fibers include various celluloses and inulin, and these can be used alone or in combination of more kinds thereof. In addition, as salts, sodium chloride, hexametaphosphate, diphosphate, sodium citrate, polyphosphate, sodium  
15 bicarbonate, and the like can be used alone or in combination of more kinds thereof.

[0036]

A method for manufacturing the foamable oil-in-water-type emulsion of the present invention can be carried out in a manner of manufacturing general creams.

Specifically, it can be obtained by mixing a fat, a stabilizing emulsifier, a  
20 demulsifier, and water which are main raw materials, and pre-emulsifying, disinfecting or sterilizing, homogenizing, and cooling these mixed raw materials. The homogenization treatment may be either pre-homogenization or post-homogenization, or may be two-stage homogenization in which both treatments are combined. It is preferable to sterilize the foamable oil-in-water-type emulsion from the viewpoint of preservability.

25 [0037]

For sterilization, there are two types which are an indirect heating method and a direct heating method. Examples of indirect heat treatment devices include APV plate-type UHT processing equipment (manufactured by APV Corporation), a CP-UHT sterilizer (manufactured by Kurimati Package Co., Ltd.), a STORK tubular-type sterilizer (manufactured by STORK Corporation), a Contherm scraping-type UHT sterilizer (manufactured by Tetra Pak Alfa Laval Co., Ltd.), and the like, but examples are not particularly limited thereto. Examples of direct heating sterilizers include an Ultra high temperature sterilizer (manufactured by Iwai Kikai Kogyo Co., Ltd.), a Uperization sterilizer (manufactured by Tetra Pak Alfa Laval Co., Ltd.), a VTIS sterilizer (manufactured by Tetra Pak Alfa Laval Co., Ltd.), and UHT sterilizers such as a Ragia UHT Sterilizer (manufactured by Ragia Inc.) and a Paralyzator (manufactured by Paasch & Silkeborg Co., Ltd.), but any of these devices may be used.

[0038]

By aseptically filling the above-mentioned foamable oil-in-water-type emulsion after sterilization which is in a liquid state into a Tetra Pak and Toppan TL-PAK, the emulsion has excellent emulsification stability at freezing temperature, refrigeration temperature, and room temperature as an aseptic filling product. In particular, it can be provided to markets as a product that can be distributed at room temperature in a temperature range of 20°C to 40°C. The aseptically filled foamable oil-in-water-type emulsion of the present invention has emulsification stability and storage stability which enable storage for 12 months at a freezing temperature to 30°C and for 6 months at 40°C.

[0039]

The following procedure can be exemplified as a method for obtaining a foamed oil-in-water-type emulsion obtained by foaming of the foamable oil-in-water-type emulsion of the present invention.

In a case where a storage temperature of the foamable oil-in-water-type emulsion is a refrigeration temperature to 30°C, it can foam at a product temperature thereof using a foaming apparatus including a vertical mixer or a continuous mixer. In a case where a storage temperature of the foamable oil-in-water-type emulsion is 30°C to 40°C, it can foam by cooling the product temperature to a refrigeration temperature to 30°C before the foaming operation. For the cooling, any of ice water immersion, water immersion, and air cooling can be employed. In the case of freezing storage, it can foam by adjusting the product temperature to a refrigeration temperature to 30°C after thawing. If desired, it can foam after adding and mixing in saccharides, taste materials, flavours, pigments, and the like before foaming.

[0040]

Overrun of a foamed oil-in-water-type emulsion obtained by foaming of the foamable oil-in-water-type emulsion of the present invention: (specific gravity before foaming/specific gravity after foaming)  $\times 100 - 100$  is approximately 100% to 500%. An overrun value rises and falls when overrun is affected by a storage temperature of the foamable oil-in-water-type emulsion, a product temperature before foaming, a foaming operation environment temperature, and a foaming device. For example, in a case where a storage temperature and a foaming temperature are as low as 5°C to 25°C, overrun tends to be as high as 300% to 500%. In a case where a storage temperature is as high as 30°C to 40°C and a foaming temperature is as high as 25°C to 30°C, overrun tends to be as low as 100% to 200%. In a case where overrun is high, the texture becomes light, but a flavor becomes poor, and in a case where overrun is low, a flavor becomes strong, but the texture tends to become slightly heavy. Accordingly, in order to obtain a foamed oil-in-water-type emulsion having a desired texture and flavor, it is necessary to appropriately select a storage temperature of the foamable oil-in-water-type

emulsion, a product temperature before foaming, a foaming operation environment temperature, and a foaming device.

[0041]

5 The foamed oil-in-water-type emulsion of the present invention can be widely used as a topping material, a coating material, a filling material, and a sandwich material in Western confectionery, bread, and cooking to improve the appearance and flavor and further increase palatability.

Examples

[0042]

10 Examples of the present invention will be described below to explain the present invention in more detail.

In the examples, “%” and “part” mean weight basis.

In addition, the results were evaluated by the following method.

[0043]

15 A. Method for evaluating stability of oil-in-water-type emulsions

(1) Viscosity:

Measurement of a viscosity of the oil-in-water-type emulsion was performed with a B-type viscometer (Model LVDV-E manufactured by BROOKFIELD) under the conditions of No. 62 spindle and 60 rpm.

20 A product temperature of the oil-in-water-type emulsion was measured at 7°C.

(2) Viscosity increase test:

50 g of the oil-in-water-type emulsion was inserted into a 100 ml beaker and incubated at 20°C for 2 hours. Thereafter, four spherical alumina ceramic balls having a weight of 7 g and a diameter of 15 mm were inserted therein and were shaken using a horizontal shaker for 10 minutes to check whether a viscosity of the oil-in-water-type

25

emulsion increased or not.

[0044]

B. Evaluation method in case where oil-in-water-type emulsion foams

(1) Whipping time:

5 A time from whipping 500 g of the oil-in-water-type emulsion with Kenwood mixer (MODEL Premier Major KMM770 manufactured by KENWOOD) at speed scale 6 (300 rpm) until reaching an optimum foaming state.

(2) Overrun: (specific gravity before foaming/specific gravity after foaming) × 100 - 100

10 (3) Shape retainability:

The flower shaped whipped oil-in-water-type emulsion when stored at 15°C for 24 hours was examined.

In order of superiority, the shape retainability was evaluated in three stages of “A,” “B,” and “C.”

15 (4) Syneresis:

The flower shaped whipped oil-in-water-type emulsion when stored at 15°C for 24 hours was examined.

Syneresis was evaluated as “No syneresis” when syneresis did not occur, and syneresis was evaluated as “Occurred” when it occurred.

20 (5) Taste/melting sensation in the mouth:

The taste and melting sensation in the mouth of the foamed oil-in-water-type emulsion were evaluated in 5 stages as follows:

Taste: 5 (favorable) to 1 (poor)

Melting sensation in the mouth: 5 (favorable) to 1 (poor)

25 [0045]

### Example 1

0.3 parts of sorbitan stearate (HLB5.1) and 0.03 parts of soybean lecithin were added, mixed, and dissolved in a mixed oil of 23.5 parts of fully melted hydrogenated palm kernel oil (rising melting point 40°C) and 2 parts of fully hydrogenated high erucic acid rapeseed oil (C22 content 52.3%, rising melting point 62°C) to obtain a fat phase. Separately, 13 parts of sugar, 0.5 parts of polyoxyethylene sorbitan stearate (HLB 14.9), 0.2 parts of sodium stearoyl lactate (HLB 9.5), and 0.01 part of polyoxyethylene sorbitan oleate (HLB 15.0) were added, mixed, and dissolved in 60.46 parts of water to obtain a water phase. The fat phase and water phase were preliminarily emulsified by high-speed stirring at 60°C for 30 minutes in a pre-emulsification tank, and then homogenized at a homogenization pressure of 1 MPa, preheated to 78°C in a plate heat exchanger, and heated to 144°C with a ultra-high temperature sterilizer (manufactured by Iwai Kikai Kogyo Co., Ltd.) (direct steam blowing system). In addition, the heated resultant was maintained at 144°C for 4 seconds in a holding tube which is a sterilization maintenance tube, and was evaporation-cooled to be cooled to 78°C. Thereafter, the cooled resultant was re-homogenized at a homogenization pressure of 12 MPa, cooled again to 5°C with a plate cooling device, and then aseptically filled into a 1-liter Tetra Pak. Thereby, an oil-in-water-type emulsion according to Example 1 was obtained. The obtained oil-in-water-type emulsion was stored in a constant-temperature tank at 35°C for 7 days. Thereafter, 500 g thereof was weighed in a Kenwood mixer, cooled to a product temperature of 25°C in cold water, and then whipped by the above-mentioned whipping method to perform measurement of a viscosity, viscosity increase test, whipping time, overrun, shape retainability, and syneresis according to the above-described method. In addition, taste of the whipped cream was evaluated.

[0046]

## Example 2

An oil-in-water-type emulsion based on Example 2 was obtained in the same manner as in Example 1 except that in Example 1, 23.5 parts of hydrogenated palm kernel oil (rising melting point 40°C) was changed to 24.9 parts, and 2 parts of fully hydrogenated high erucic acid rapeseed oil (rising melting point 62°C) was changed to 0.6 parts. After storage under the same conditions as in Example 1, cooling was performed under the same conditions as in Example 1, and a foamable oil-in-water-type emulsion of Example 2 was evaluated in the same manner as in Example 1.

[0047]

## 10 Example 3

An oil-in-water-type emulsion based on Example 3 was obtained in the same manner as in Example 1 except that in Example 1, 23.5 parts of hydrogenated palm kernel oil (rising melting point 40°C) was changed to 22.5 parts, and 2 parts of fully hydrogenated high erucic acid rapeseed oil (rising melting point 62°C) was changed to 3 parts. After storage under the same conditions as in Example 1, cooling was performed under the same conditions as in Example 1, and a foamable oil-in-water-type emulsion of Example 3 was evaluated in the same manner as in Example 1.

[0048]

## Example 4

20 An oil-in-water-type emulsion based on Example 4 was obtained in the same manner as in Example 1 except that in Example 1, 60.46 parts of water was changed to 63.46 parts, and 13 parts of sugar was changed to 10 parts. After storage under the same conditions as in Example 1, cooling was performed under the same conditions as in Example 1, and a foamable oil-in-water-type emulsion of Example 4 was evaluated in the same manner as in Example 1.

[0049]

#### Example 5

An oil-in-water-type emulsion based on Example 5 was obtained in the same manner as in Example 1 except that in Example 1, 60.46 parts of water was changed to 53.46 parts, and 13 parts of sugar was changed to 20 parts. After storage under the same conditions as in Example 1, cooling was performed under the same conditions as in Example 1, and a foamable oil-in-water-type emulsion of Example 5 was evaluated in the same manner as in Example 1.

[0050]

#### Comparative Example 1

An oil-in-water-type emulsion based on Comparative Example 1 was obtained in the same manner as in Example 1 except that in Example 1, 23.5 parts of hydrogenated palm kernel oil (rising melting point 40°C) was changed to 25.5 parts, and 2 parts of fully hydrogenated high erucic acid rapeseed oil (rising melting point 62°C) was not added. After storage under the same conditions as in Example 1, cooling was performed under the same conditions as in Example 1, and a foamable oil-in-water-type emulsion of Comparative Example 1 was evaluated in the same manner as in Example 1.

[0051]

Table 1 shows the test results of Examples 1 to 5 and Comparative Examples 1 and 2.

Table 1

|                                                  | Example 1 | Example 2 | Example 3 | Example 4 | Example 5 | Comparative Example 1 | Comparative Example 2 |
|--------------------------------------------------|-----------|-----------|-----------|-----------|-----------|-----------------------|-----------------------|
| Hydrogenated palm kernel oil at 40°C             | 23.50     | 24.90     | 22.50     | 23.50     | 23.50     | 25.50                 | 21.50                 |
| Fully hydrogenated high erucic acid rapeseed oil | 2.00      | 0.60      | 3.00      | 2.00      | 2.00      |                       | 4.00                  |

|                                            |                  |                  |                  |                  |                  |                |                  |
|--------------------------------------------|------------------|------------------|------------------|------------------|------------------|----------------|------------------|
| Sugar                                      | 13.00            | 13.00            | 13.00            | 10.00            | 20.00            | 13.00          | 13.00            |
| Water                                      | 60.46            | 60.46            | 60.46            | 63.46            | 53.46            | 60.46          | 60.46            |
| Fat content (wt%)                          | 25.5             | 25.5             | 25.5             | 25.5             | 25.5             | 25.5           | 25.5             |
| Total solid content (wt%)                  | 39.5             | 39.5             | 39.5             | 36.5             | 46.5             | 39.5           | 39.5             |
| Stabilizing emulsifier X (wt%)             | 1.00             | 1.00             | 1.00             | 1.00             | 1.00             | 1.00           | 1.00             |
| Demulsifier Y (wt%)                        | 0.04             | 0.04             | 0.04             | 0.04             | 0.04             | 0.04           | 0.04             |
| X/Y                                        | 25.0             | 25.0             | 25.0             | 25.0             | 25.0             | 25.0           | 25.0             |
| X + Y                                      | 1.04             | 1.04             | 1.04             | 1.04             | 1.04             | 1.04           | 1.04             |
| Viscosity (cP)                             | 154              | 487              | 140              | 128              | 364              | Solidified     | 129.0            |
| Viscosity increase test                    | 10 min or longer | 3 min and 30 sec | 10 min or longer | 10 min or longer | 7 min and 25 sec | Not measurable | 10 min or longer |
| Whipping time                              | 3 min and 0 sec  | 1 min and 5 sec  | 4 min and 30 sec | 4 min and 45 sec | 1 min and 32 sec | Not measurable | 5 min and 20 sec |
| Overrun (%)                                | 160              | 145              | 220              | 320              | 123              | Not evaluable  | 280              |
| Shape retainability                        | A                | A                | A                | B                | A                | Not evaluable  | B                |
| Syneresis                                  | No syneresis     | No syneresis     | No syneresis     | Occurred         | No syneresis     | Not evaluable  | Occurred         |
| Taste                                      | 5                | 4                | 4                | 3                | 4                | Not evaluable  | 3                |
| Melting sensation                          | 4                | 5                | 3                | 4                | 4                | Not evaluable  | 2                |
| Storage temperature before foaming (°C)    | 35               | 35               | 35               | 35               | 35               | 35             | 35               |
| Controlled temperature before foaming (°C) | 25               | 25               | 25               | 25               | 25               | 25             | 25               |

[0052]

As shown in Table 1, excellent emulsification stability, excellent storage stability at 35°C, and favorable room-temperature foaming performance at 25°C were exhibited in all of Example 1 (92.2:7.8) and Example 2 (97.6:2.4) and Example 3 (88.2:11.8) in which

5 a blending ratio of the hydrogenated palm kernel oil that is a laurin-based fat having a rising melting point of 40°C to the fully hydrogenated high erucic acid rapeseed oil in which C22 saturated fatty acids represented 10 to 75 wt% of all constituent fatty acids corresponded to 88 to 98:2 to 12. In Comparative Example 1 using only hydrogenated palm kernel oil that is a laurin-based fat having a rising melting point of 40°C,

10 emulsification stability was poor, and a foaming performance could not be evaluated. In Comparative Example 2 in which a blending ratio of the hydrogenated palm kernel oil to the fully hydrogenated high erucic acid rapeseed oil was 84.3:15.7, both the

emulsification stability and room-temperature foaming performance were favorable, but melting sensation in the mouth of the foamed oil-in-water-type emulsion was slightly poor.

[0053]

## 5            Example 6

0.3 parts of sorbitan stearate (HLB 5.1), 0.5 parts of polyglycerin behenate (C22 content 70% in all constituent fatty acids, HLB 4.1), and 0.03 parts of soybean lecithin were added, mixed, and dissolved in 25.5 parts of a completely melted hydrogenated palm kernel oil (rising melting point 40°C) to obtain a fat phase. Separately, 13 parts of  
10    sugar, 0.5 parts of polyoxyethylene sorbitan stearate (HLB 14.9), 0.2 parts of sodium stearyl lactate, and 0.01 part of polyoxyethylene sorbitan oleate (HLB 15.0) were added, mixed, and dissolved in 59.96 parts of water to obtain a water phase. The fat phase and water phase were preliminarily emulsified by high-speed stirring at 60°C for 30 minutes in a pre-emulsification tank, and then homogenized at a homogenization pressure of 1  
15    MPa, preheated to 78°C in a plate heat exchanger, and heated to 144°C with a ultra-high temperature sterilizer (manufactured by Iwai Kikai Kogyo Co., Ltd.) (direct steam blowing system). In addition, the heated resultant was maintained at 144°C for 4 seconds in a holding tube which is a sterilization maintenance tube, and was evaporation-cooled to be cooled to 78°C. Thereafter, the cooled resultant was  
20    re-homogenized at a homogenization pressure of 12 MPa, cooled again to 5°C with a plate cooling device, and then aseptically filled into a 1-liter Tetra Pak. Thereby, an oil-in-water-type emulsion according to Example 6 was obtained. The obtained oil-in-water-type emulsion was stored in a constant-temperature tank at 35°C for 7 days. Thereafter, 500 g thereof was weighed in a Kenwood mixer, cooled to a product  
25    temperature of 25°C in cold water, and then whipped by the above-mentioned whipping

method to perform measurement of a viscosity, viscosity increase test, whipping time, overrun, shape retainability, and syneresis according to the above-described method. In addition, taste of the whipped cream was evaluated.

[0054]

5           Example 7

An oil-in-water-type emulsion based on Example 7 was obtained in the same manner as in Example 6, except that in Example 6, 0.5 parts of polyglycerin behenate was changed to sucrose behenate (C22 content 70% in all constituent fatty acids, HLB 4.0). After storage under the same conditions as in Example 6, cooling was performed  
10 under the same conditions as in Example 6, and a foamable oil-in-water-type emulsion of Example 7 was evaluated in the same manner as in Example 6.

[0055]

Example 8

An oil-in-water-type emulsion based on Example 8 was obtained in the same  
15 manner as in Example 6 except that in Example 6, 25.5 parts of the hydrogenated palm kernel oil (rising melting point 40°C) was changed to 25.2 parts of the hydrogenated palm kernel oil (rising melting point 40°C) and 0.3 parts of a fully hydrogenated high erucic acid rapeseed oil (C22 content 52.3%, rising melting point 62°C), and 0.5 parts of polyglycerin behenate was changed to 0.2 parts. After storage under the same  
20 conditions as in Example 6, cooling was performed under the same conditions as in Example 6, and a foamable oil-in-water-type emulsion of Example 8 was evaluated in the same manner as in Example 6.

[0056]

Example 9

25           An oil-in-water-type emulsion based on Example 9 was obtained in the same

manner as in Example 6 except that in Example 6, 25.5 parts of the hydrogenated palm kernel oil (rising melting point 40°C) was changed to 15 parts of an fully hydrogenated oil of a high-melting point part of palm kernel fractionation (rising melting point 35°C) and 10.5 parts of a hydrogenated palm kernel oil (rising melting point 38°C). After storage under the same conditions as in Example 6, cooling was performed under the same conditions as in Example 6, and a foamable oil-in-water-type emulsion of Example 9 was evaluated in the same manner as in Example 6.

[0057]

Table 2 shows the test results of Examples 6 to 9.

Table 2

|                                                                  | Example 6        | Example 7        | Example 8        | Example 9        |
|------------------------------------------------------------------|------------------|------------------|------------------|------------------|
| Hydrogenated palm kernel oil at 40°C                             | 25.50            | 25.50            | 25.50            |                  |
| Fully hydrogenated oil of high-melting point part of palm kernel |                  |                  |                  | 15.00            |
| Hydrogenated palm kernel oil at 38°C                             |                  |                  |                  | 10.50            |
| Fully hydrogenated high erucic acid rapeseed oil                 |                  |                  | 0.30             |                  |
| Sugar                                                            | 13.00            | 13.00            | 13.00            | 13.00            |
| Water                                                            | 59.96            | 59.96            | 60.16            | 59.96            |
| Polyglycerin behenate                                            | 0.50             |                  | 0.20             | 0.50             |
| Sucrose behenate                                                 |                  | 0.50             |                  |                  |
| Fat content (wt%)                                                | 25.5             | 25.5             | 25.5             | 25.5             |
| Total solid content (wt%)                                        | 40.0             | 40.0             | 39.7             | 40.0             |
| Stabilizing emulsifier X (wt%)                                   | 1.50             | 1.50             | 1.20             | 1.50             |
| Demulsifier Y (wt%)                                              | 0.04             | 0.04             | 0.04             | 0.04             |
| X/Y                                                              | 37.5             | 37.5             | 31.0             | 37.5             |
| X + Y                                                            | 1.54             | 1.54             | 1.24             | 1.54             |
| Viscosity (cP)                                                   | 154              | 487              | 140              | 145              |
| Viscosity increase test                                          | 10 min or longer | 10 min or longer | 10 min or longer | 10 min or longer |
| Whipping time                                                    | 3 min and 25 sec | 3 min and 18 sec | 3 min and 0 sec  | 3 min and 10 sec |
| Overrun (%)                                                      | 152              | 155              | 160              | 145              |
| Shape retainability                                              | A                | A                | A                | A                |
| Syneresis                                                        | No syneresis     | No syneresis     | No syneresis     | No syneresis     |
| Taste                                                            | 5                | 5                | 5                | 5                |
| Melting sensation                                                | 4                | 4                | 5                | 5                |
| Storage temperature before foaming (°C)                          | 35               | 35               | 35               | 35               |
| Controlled temperature before foaming (°C)                       | 25               | 25               | 25               | 25               |

[0058]

Excellent emulsification stability, excellent storage stability at 35°C, and favorable room-temperature foaming performance at 25°C were exhibited in all of Examples 6 and 7 in which only a hydrogenated palm kernel oil (rising melting point 40°C) was used as a fat, and polyglycerin behenate or sucrose behenate in which a main constituent fatty acid residue is C20-24 saturated fatty acids was blended in as a lipophilic emulsifier. Excellent emulsification stability, excellent storage stability at 35°C, favorable room-temperature foaming performance at 25°C, and extremely favorable melting sensation in the mouth of a foamed oil-in-water-type emulsion were exhibited in Example 8 in which 25.0 parts of a hydrogenated palm kernel oil (rising melting point 40°C) and 0.5 parts of a fully hydrogenated high erucic acid rapeseed oil were used as fats, and polyglycerin behenate was further blended in. Favorable emulsification stability, favorable room-temperature foaming performance, and extremely favorable melting sensation in the mouth of a foamed oil-in-water-type emulsion were exhibited in Example 9 in which 15 parts of an fully hydrogenated oil of a high-melting point part of palm kernel fractionation (rising melting point 35°C) and 10.5 parts of a hydrogenated palm kernel oil (rising melting point 38°C) were used as fats.

[0059]

#### Example 10

0.3 parts of sorbitan stearate (HLB5.1) and 0.03 parts of soybean lecithin were added, mixed, and dissolved in a mixed oil of 23.5 parts of fully melted hydrogenated palm kernel oil (rising melting point 40°C) and 2 parts of fully hydrogenated high erucic acid rapeseed oil (C22 content 52.3%, rising melting point 62°C) to obtain a fat phase. Separately, 13 parts of sugar, 0.5 parts of polyoxyethylene sorbitan stearate (HLB 14.9), 0.3 parts of sodium caseinate, 0.1 parts of sodium stearoyl lactate, 0.3 parts of hydroxypropylmethylcellulose, 0.1 parts of sodium hexametaphosphate, 0.1 parts of salt,

and 0.1 parts of milk flavor were added, mixed, and dissolved in 61.4 parts of water to obtain a water phase. The fat phase and water phase were preliminarily emulsified by high-speed stirring at 60°C for 30 minutes in a pre-emulsification tank, and then homogenized at a homogenization pressure of 1 MPa, preheated to 78°C in a plate heat exchanger, and heated to 144°C with a ultra-high temperature sterilizer (manufactured by Iwai Kikai Kogyo Co., Ltd.) (direct steam blowing system). In addition, the heated resultant was maintained at 144°C for 4 seconds in a holding tube which is a sterilization maintenance tube, and was evaporation-cooled to be cooled to 78°C. Thereafter, the cooled resultant was re-homogenized at a homogenization pressure of 12 MPa, cooled again to 5°C with a plate cooling device, and then aseptically filled into a 1-liter Tetra Pak. Thereby, an oil-in-water-type emulsion according to Example 10 was obtained. The obtained oil-in-water-type emulsion was stored in a constant-temperature tank at 5°C for 7 days. Thereafter, 500 g thereof was weighed in a Kenwood mixer, heated to a product temperature of 25°C in warm water, and then whipped by the same whipping method as in Example 1 to perform measurement of a viscosity, viscosity increase test, whipping time, overrun, shape retainability, and syneresis according to the same method as in Example 1. In addition, taste of the whipped cream was evaluated.

[0060]

#### Example 11

Evaluation of whipping and whipped cream was performed in the same manner as in Example 1 except that in Example 10, the storage for 7 days in a 5°C constant-temperature tank was changed to storage for 7 days in a 30°C constant-temperature tank, and cooling was performed to 5°C using ice water before foaming.

[0061]

#### Example 12

Evaluation of whipping and whipped cream was performed in the same manner as in Example 1 except that in Example 11, the cooling to 5°C using ice water before foaming was changed to cooling to 25°C using cold water.

5 [0062]

#### Example 13

Evaluation of whipping and whipped cream was performed in the same manner as in Example 1 except that in Example 11, the cooling to 5°C using ice water before foaming was changed to maintaining a product temperature at 30°C without cooling.

10 [0063]

#### Example 14

Evaluation of whipping and whipped cream was performed in the same manner as in Example 1 except that in Example 10, the storage for 7 days in a 5°C constant-temperature tank was changed to storage for 7 days in a 35°C constant-temperature tank, and cooling was performed to 25°C using ice water before foaming.

[0064]

#### Example 15

Evaluation of whipping and whipped cream was performed in the same manner as in Example 1 except that in Example 10, the storage for 7 days in a 5°C constant-temperature tank was changed to storage for 7 days in a 40°C constant-temperature tank, and cooling was performed to 25°C using ice water before foaming.

[0065]

25 Comparative Example 3

Evaluation of whipping and whipped cream was performed in the same manner as in Example 1 except that in Example 14, the cooling to 25°C using ice water before foaming was changed to cooling to 30°C using ice water before foaming.

[0066]

5 Table 3 shows the test results of Examples 10 to 15 and Comparative Example 3.

Table 3

|                                                  | Example 10       | Example 11       | Example 12       | Example 13       | Example 14       | Example 15       | Comparative Example 3 |
|--------------------------------------------------|------------------|------------------|------------------|------------------|------------------|------------------|-----------------------|
| Storage temperature before foaming (°C)          | 5                | 30               | 30               | 30               | 35               | 40               | 35                    |
| Controlled temperature before foaming (°C)       | 25               | 5                | 25               | 30               | 25               | 25               | 30                    |
| Hydrogenated palm kernel oil at 40°C             | 23.50            | 23.50            | 23.50            | 23.50            | 23.50            | 23.50            | 23.50                 |
| Fully hydrogenated high erucic acid rapeseed oil | 2.00             | 2.00             | 2.00             | 2.00             | 2.00             | 2.00             | 2.00                  |
| Sugar                                            | 13.00            | 13.00            | 13.00            | 13.00            | 13.00            | 13.00            | 13.00                 |
| Sodium caseinate                                 | 0.30             | 0.30             | 0.30             | 0.30             | 0.30             | 0.30             | 0.30                  |
| Water                                            | 61.40            | 61.40            | 61.40            | 61.40            | 61.40            | 61.40            | 61.40                 |
| Fat content (wt%)                                | 25.5             | 25.5             | 25.5             | 25.5             | 25.5             | 25.5             | 25.5                  |
| Total solid content (wt%)                        | 39.6             | 39.6             | 39.6             | 39.6             | 39.6             | 39.6             | 39.6                  |
| Stabilizing emulsifier X (wt%)                   | 0.80             | 0.80             | 0.80             | 0.80             | 0.80             | 0.80             | 0.80                  |
| Demulsifier Y (wt%)                              | 0.03             | 0.03             | 0.03             | 0.03             | 0.03             | 0.03             | 0.03                  |
| X/Y                                              | 26.7             | 26.7             | 26.7             | 26.7             | 26.7             | 26.7             | 26.7                  |
| X + Y                                            | 0.83             | 0.83             | 0.83             | 0.83             | 0.83             | 0.83             | 0.83                  |
| Viscosity (cP)                                   | 60               | 105              | 92               | 88               | 154              | 190              | 192                   |
| Viscosity increase test                          | 10 min or longer | 10 min or longer | 10 min or longer | 10 min or longer | 10 min or longer | 10 min or longer | 10 min or longer      |
| Whipping time                                    | 3 min and 15 sec | 1 min and 45 sec | 2 min and 50 sec | 5 min and 30 sec | 3 min and 0 sec  | 2 min and 45 sec | Not measurable        |
| Overrun (%)                                      | 160              | 145              | 220              | 320              | 123              | 121              | Not measurable        |
| Shape retainability                              | A                | A                | A                | A                | A                | A                | Not measurable        |
| Syneresis                                        | No syneresis     | No syneresis     | No syneresis     | No syneresis     | No syneresis     | No syneresis     | Not measurable        |
| Taste                                            | 5                | 5                | 5                | 5                | 5                | 5                | Not measurable        |
| Melting sensation                                | 4                | 4                | 4                | 4                | 4                | 4                | Not measurable        |

[0067]

The foamable oil-in-water-type emulsions of Examples 10 to 15 which have a

storage temperature before foaming of 5°C to 40°C all could foamed without causing any problems by controlling their temperatures to 5°C to 30°C before foaming, and the foamed oil-in-water-type emulsions had favorable shape retainability, syneresis resistance, taste, and melting sensation in the mouth. However, in Comparative

5 Example 3 in which the foamable oil-in-water-type emulsion having a storage temperature before foaming of 35°C was temperature-controlled to 30°C before foaming, foaming was impossible. Based on these results and the results of Examples 14 and 15, it could be confirmed that, in a case where a storage temperature before foaming was 35°C to 40°C, foaming was possible by cooling to 25°C or less before foaming.

10 [Industrial Applicability]

[0068]

According to the present invention, it is possible to provide an oil-in-water-type emulsion that has emulsification stability for storage at room temperature such as 20°C to 40°C, and that can foam, after storage at room temperature, at refrigeration temperature  
15 to room temperature such as 3°C to 30°C; and a method for manufacturing a foamed oil-in-water-type emulsion.

[CLAIMS]

[Claim 1]

A foamable oil-in-water-type emulsion comprising:

10 to 30 wt% of fats;

5 a stabilizing emulsifier and a demulsifier as emulsifiers, wherein, in a case where a content of the stabilizing emulsifier is X wt% and a content of the demulsifier is Y wt%, a value of (X/Y) is 10 or more, and a total amount of X and Y is 0.1 to 3 wt%;

10 to 20 wt% of saccharides; and

water,

10 wherein a total solid content is 39.5 to 50 wt%,

a temperature of the foamable oil-in-water-type emulsion is adjusted to 3°C to 25°C and then allowed to foam after being stored at 20°C to 40°C, and

the foamable oil-in-water-type emulsion satisfies any one selected from the following i), ii), iii), and iv):

15 i) the fats are a fat C formed of 88 to 98 wt% of a fat A that is a laurin-based fat having a rising melting point of 35°C to 42°C, and 2 to 12 wt% of a fat B that is an fully hydrogenated high erucic acid rapeseed oil in which C22 saturated fatty acids represent 20 to 60 wt% of all constituent fatty acids,

20 ii) the fats are the fat A and contain, as lipophilic emulsifiers, one or more kinds of glycerin fatty acid ester, sucrose fatty acid ester, sorbitan fatty acid ester, polyglycerin fatty acid ester, and propylene glycol fatty acid ester, in which a content of C20-24 saturated fatty acids in all constituent fatty acids is 50 wt% or more,

iii) the fats are the fat C and further contain the lipophilic emulsifiers described in ii), and

25 iv) the fats are a fat D formed of more than 98 wt% and less than 100 wt% of the

fat A, and more than 0 wt% and less than 2 wt% of the fat B; and further contain the lipophilic emulsifiers described in ii).

[Claim 2]

The foamable oil-in-water-type emulsion according to claim 1, wherein the fat A  
5 is one or more kinds selected from fractionated oil, hydrogenated oil, and transesterified oil of palm kernel oil, palm oil, and babassu oil.

[Claim 3]

The foamable oil-in-water-type emulsion according to claim 1, wherein a  
content of the lipophilic emulsifiers according to claim 1 is 0.1 to 3 wt% with respect to  
10 the foamable oil-in-water-type emulsion.

[Claim 4]

The foamable oil-in-water-type emulsion according to claim 1, wherein, as the  
saccharides, 5 to 25 wt% of one or more kinds selected from starch decomposition  
products, oligosaccharides, disaccharides, monosaccharides, and sugar alcohols are  
15 contained.

[Claim 5]

A method for manufacturing a foamed oil-in-water-type emulsion, the method  
comprising:

storing the foamable oil-in-water-type emulsion according to claim 1 at 20°C to  
20 40°C;  
thereafter adjusting the temperature to 3°C to 25°C; and  
thereafter allowing the foamable oil-in-water-type emulsion to foam.