

PLASTIC WATER-IN-OIL EMULSION FOR LAYERED WHEAT FLOUR PUFFED
FOOD

5

BACKGROUND OF THE INVENTION

1. Field of the Invention

[0001] The present invention generally relates to a plastic water-in-oil emulsion suitable for a layered wheat flour puffed food such as a pie, a croissant, and a Danish pastry, and in particular, to a plastic water-in-oil emulsion suitable for "shortcrust
10 pastry" and "shortcrust puff pastry".

2. Description of Related Art

[0002] Pie, as one of the layered wheat flour puffed food, is substantially classified into "puff pastry", "shortcrust pastry", and "shortcrust puff pastry".

[0003] The "puff pastry" is obtained by wrapping a sheet-like margarine (roll-in
15 oil-and-fat) into a wheat flour dough, repeatedly folding and rolling out the dough, and then forming a layered structure composed of about totally 100 layers of wheat flour dough layers and oil-and-fat layers, and finally backing the layered structure. The "puff pastry" has the features of expanded volume and soft mouthfeel. However, it is easily peeled off layer by layer, so that it has the disadvantage of a dry sensation in
20 mouth.

[0004] The "shortcrust pastry" is obtained by kneading the margarine into wheat flour to such an extent that the margarine becomes too small to be seen, adding water to finely disperse the margarine into the dough, rolling out and shaping the dough in the above

state, and then baking the dough. Unlike the puff pastry, a structure with numerous tiny pores is formed instead of layers, so that it has a desirable shape-retentive property and it is difficult to be fragmentized. However, it tastes hard as it is formed with a biscuit shape.

5 [0005] In the application of "shortcrust pastry", margarine products are cut into an appropriate size in advance. For example, Patent Document 2 has disclosed a chip-shaped margarine and a preparation method thereof.

[0006] The "shortcrust puff pastry" is obtained by kneading margarine in a form of visible chips into the wheat flour, adding water to loosely disperse the margarine into the
10 dough, rolling out and shaping the dough in the above state, and then baking the dough. Unlike the uniform layered structure of the puff pastry, the pie prepared through the above manner has a structure of complex fine layers. Though the volume thereof is smaller than that of the puff pastry, it is short, crispy, and has excellent mouth-melting characteristics and swallowing sensations when being chewed.

15 [0007] The oil-and-fat for being rolled in the "puff pastry" is required to have a suitable plasticity/extendibility under working temperature. For example, Patent Document 1 has mentioned that the oil-and-fat must have an SFC value in the range of 50%-20% under a standard operative temperature (10°C-30°C) which is dramatically decreased if the temperature is above 30°C, and the oil-and-fat is quickly melted at a
20 temperature approaching the body temperature.

[0008] The margarines used in "shortcrust pastry" and "shortcrust puff pastry" merely have different shapes, and both of them are substantially based on formulating the roll-in oil-and-fat.

[0009] However, the oil-and-fat for margarine generally adopts an oil-and-fat hardened by hydrogenation. Hardening of the oil-and-fat by hydrogenation aims at, for example, ensuring the plasticity in a larger temperature range and crystallizing the oil-and-fat into a better state. However, a completely hydrogenated hardened oil, i.e. a
5 highly hydrogenated oil-and-fat, contains trans fatty acid. Nowadays, with the improvement in the health consciousness of the market and users, the trans fatty acid is persistently avoided.

[0010] The hardened oil containing trans fatty acid is not used, and instead, one of the following solid fat ingredients may be selected, for example, palm oil, coconut oil, palm
10 kernel oil, fractionated fat of such oil, a highly hydrogenated oil, as well as other solid fat containing no trans fatty acid. However, if the solid fat is only mixed simply, the plasticity range thereof is rather narrow, and a waxy sensation occurs. If the palm oil is used, the problem of, for example, coarse crystals occurs. Therefore, the transesterifications of such oil-and-fat or liquid oil ingredients have been widely carried
15 out. For example, Patent Document 3 has disclosed plastic oil-and-fat obtained through the transesterification of the solid fat derived from the palm oil with a lauric acid-based oil-and-fat substantially contains no trans fatty acid. However, if a lot of transesterified oil is used to improve the plasticity, the hardness at a low temperature is increased, thereby causing a poor mouth-melting characteristic and affecting the
20 mouthfeel sense. On the other hand, in order to improve the mouth-melting characteristic, a part of the oil-and-fat is leached out of the dough, which results in a poor extendibility or uneven layers of the layered wheat flour puffed food such as pie/croissant/Danish pastry, thereby deteriorating the puffing-up feature thereof.

[0011] Patent Document 4 has disclosed a method of using a highly hydrogenated oil of fish oil, without conducting transesterifications. However, since the highly hydrogenated oil is formulated therein, the mouth-melting characteristic becomes worse. Moreover, it is well known that the lauric acid-based oil-and-fat such as palm kernel oil is used as the conventional raw material oil for the margarine, which is used as a main body especially in European products (Non-Patent Document 1, and Non-Patent Document 2).

[0012] As described above, as far as the margarine for the layered wheat flour puffed food such as pie/croissant/Danish pastry is concerned, it is difficult to obtain margarine for the layered wheat flour puffed food having both desirable extendibility and wonderful mouth-melting characteristic and substantially containing no trans fatty acid.

[0013] [Patent Document 1] Japanese Patent Publication No. S63-160549

[0014] [Patent Document 2] Japanese Patent Publication No. 2001-252014

[0015] [Patent Document 3] Japanese Patent Publication No. 2001-262181

[0016] [Patent Document 4] Japanese Patent Publication No. H09-143490

[0017] [Non-Patent Document 1] "Corpus of Margarine, Shortening, Lard, and Plastic Oil-and-fat" P331, Kimitoshi Nakazawa, KORIN PUBLISHING CO., LTD.

[0018] [Non-Patent Document 2] Journal of Oleo Science, Vol. 9, No. 4 (1960) P201-207

SUMMARY OF THE INVENTION

[0019] [Problems to be solved in the invention]

[0020] Accordingly, the present invention is directed to a plastic water-in-oil emulsion,

which has excellent physical properties suitable for a layered wheat flour puffed food such as a pie/croissant/Danish pastry, and substantially contains no trans fatty acid.

[0021] [Methods for solving the problems]

[0022] In order to solve the above problems, the inventors exert their efforts to study properties of margarine, especially the properties of margarine suitable for the preparation process of "shortcrust pastry" and "shortcrust puff pastry" that are not mentioned ever before in the previous researches, and achieve the following technical solution. When a hard oil-and-fat mainly composed of lauric acid, such as palm kernel oil, a highly hydrogenated oil of palm kernel oil, a high-melting-point fraction of palm kernel oil, and a highly hydrogenated oil of a palm kernel fractionated oil substantially containing no trans fatty acid, and a margarine having a hardness that is impossible for a conventional margarine are used together, a better dough suitable for a layered wheat flour puffed food can be surprisingly formulated. After the dough is baked, a layered wheat flour puffed food with desirable crisp and mouth-melting sensations can be obtained.

[0023] Therefore, the present invention includes the following key features:

- (1) a plastic water-in-oil emulsion for a layered wheat flour puffed food, containing 10 wt%-50 wt% of a hard oil-and-fat mainly composed of lauric acid, in which an oil phase has an SFC value of 50 or greater at 10°C, and 10 or less at 35°C;
- (2) the plastic water-in-oil emulsion for a layered wheat flour puffed food according to Item (1), in which the plastic water-in-oil emulsion substantially contains no trans fatty acid;
- (3) the plastic water-in-oil emulsion for a layered wheat flour puffed food according to

Item (1), in which the plastic water-in-oil emulsion contains 1 wt%-10 wt% of an oxidized starch;

(4) a method for making a dough for a layered wheat flour puffed food, including mixing and stirring the plastic water-in-oil emulsion for a layered wheat flour puffed food according to any one of Item (1) to Item (3) shaped with a volume of 15 cc-1500 cc and a wheat flour;

(5) a layered wheat flour puffed food, in which the layered wheat flour puffed food is obtained by baking the dough for the layered wheat flour puffed food according to Item (4).

10 [0024] [Effects of the invention]

[0025] When the plastic water-in-oil emulsion of the present invention is used, a layered wheat flour puffed food substantially containing no trans fatty acid and having desirable flavor and mouthfeel can be produced such as pie/Danish pastry.

15 BRIEF DESCRIPTION OF THE DRAWINGS

[0026] No drawings.

DESCRIPTION OF THE EMBODIMENTS

[0027] Reference will now be made in detail to the present embodiments of the invention, examples of which are illustrated in the accompanying drawings. Wherever possible, the same reference numbers are used in the drawings and the description to refer to the same or like parts.

[0028] The plastic water-in-oil emulsion for a layered wheat flour puffed food of the

present invention contains 10 wt%-50 wt% of a hard oil-and-fat mainly composed of lauric acid. According to the present invention, in the so-called hard oil-and-fat mainly composed of lauric acid, the content of lauric acid as the fatty acid component in the oil-and-fat is 45 wt% or above 45 wt%, and the content of oleic acid is 10 wt% or less than 10 wt% of the oil-and-fat. The specific examples include a high-melting-point fraction of palm kernel oil, a highly hydrogenated oil of palm kernel oil, a highly hydrogenated oil of a palm kernel fractionated oil (which are all referred to as "solid fat derived from palm kernel oil"), and transesterified oil-and-fat of the solid fat derived from palm kernel oil or coconut oil with a highly hydrogenated oil mainly composed of a non-lauric acid, such as a highly-hydrogenated high erucic acid rapeseed oil. Any one or two or more than two of the oil-and-fat, especially the solid fat derived from palm kernel oil can be suitably used.

[0029] The high-melting-point fraction of palm kernel oil is a high-melting-point fraction obtained by fractioning the palm kernel oil into a high-melting-point fraction and a low-melting-point fraction, in which the melting point of the high-melting-point fraction is preferably in the range of 25°C-40°C, and the iodine value is preferably equal to or less than 8.

[0030] The highly hydrogenated oil of palm kernel oil is a highly hydrogenated oil obtained by completely hydrogenating the palm kernel oil, in which the substantial ratio of the trans fatty acid is 0%.

[0031] Furthermore, the highly hydrogenated oil of palm kernel fractionated oil mainly refers to a highly hydrogenated oil of the high-melting-point fraction of palm kernel oil and a highly hydrogenated oil of the low-melting-point fraction of palm kernel oil, in

which the substantial ratios of the trans fatty acid are both 0%.

[0032] Among the above oil-and-fat, the high-melting-point fraction of the palm kernel oil that is not highly hydrogenated is preferred. If more highly hydrogenated oil of the low-melting-point fraction is used, the waxy sensation is increased.

5 [0033] The formulation amount of the above hard oil-and-fat mainly composed of lauric acid is preferably 17 wt%-40 wt%. If the formulation amount is lowered, the mouth-melting sensation tends to become worse. If the formulation amount is less than 10 wt%, the mouth-melting sensation becomes worse. If the formulation amount exceeds 40 wt%, excessive solidification occurs in the low temperature region.

10 [0034] The oil phase of the plastic water-in-oil emulsion is formed by incorporating the oil-and-fat other than the above hard oil-and-fat mainly composed of lauric acid. The specific example of the incorporated oil-and-fat includes: vegetable oil-and-fat, such as rapeseed oil, soy bean oil, sunflower seed oil, cotton seed oil, peanut oil, rice
15 bran oil, corn oil, safflower oil, olive oil, kapok oil, sesame oil, evening primrose oil, palm oil, shea butter, sal butter, cocoa butter, coconut oil, and palm kernel oil; and animal oil-and-fat, such as milk fat, beef tallow, lard, fish oil, and whale oil. The above oil-and-fat can be used alone, or used in a form of any mixture thereof. Alternatively, a processed oil-and-fat substantially containing no trans fatty acid can be use that is obtained from the above oil-and-fat processed by highly hydrogenation,
20 fractionation, or transesterifications. However, in order to satisfy the following SFC conditions, only the selection of liquid oil is actually excluded. Further specific examples for the incorporated oil-and-fat include: transesterified oil of 50 wt%-70 wt% of palm oil with 30 wt%-50 wt% of lauric acid-based oil-and-fat such as palm kernel oil,

which can be suitably used.

[0035] In the present invention, the so-called "substantially containing no trans fatty acid" means that the amount of trans fatty acid contained in oil-and-fat is less than or equal to the amount of trans fatty acid contained in the natural oil-and-fat. Therefore, 5 for example, when a natural oil-and-fat containing trace trans fatty acid, such as milk fat, the amount of the contained trans fatty acid is not considered.

[0036] A solid fat content (SFC) value of the oil-and-fat for the oil phase is required to be greater than or equal to 50 at 10°C, preferably greater than or equal to 55, and more preferably be greater than or equal to 65. Particularly, when an oil-and-fat with 10 an appropriate size suitable for "shortcrust pastry" or "shortcrust puff pastry" is used, the SFC value is preferably greater than or equal to 60 at 10°C, which may affect the hardness of the water-in-oil emulsion composition.

[0037] The SFC value of the oil-and-fat for the oil phase at 35°C is an index of the mouth-melting characteristic (waxy sensation). The SFC value must be less than or 15 equal to 10, and preferably less than or equal to 5. If the value exceeds 10, the mouth-melting characteristic becomes poor, and a strong waxy sensation is felt.

[0038] The oil phase of the plastic water-in-oil emulsion of the present invention is formulated at a ratio of 50 wt%-90 wt%, and preferably 55 wt%-85 wt% relative to the plastic water-in-oil emulsion. If the ratio of the oil phase is less than the lower limit, it 20 is difficult to obtain the water-in-oil composition, and the situation becomes even worse if a synthetic emulsifying agent is not used. On the other hand, if the ratio of the oil phase exceeds the upper limit, a sufficient mouthfeel sensation improvement effect cannot be achieved when being used in a layered wheat flour puffed food such as

pie/croissant/Danish pastry.

[0039] Water in the plastic water-in-oil emulsion of the present invention is formulated at a ratio of 5 wt%-45 wt% relative to the plastic water-in-oil emulsion. If the water content is less than the lower limit, it is difficult to obtain the water-in-oil composition, and the situation becomes even worse if the synthetic emulsifying agent is not used, and thus a unique mouthfeel sensation cannot be achieved. On the other hand, if the water content exceeds the upper limit, it is difficult to obtain the water-in-oil composition.

[0040] Generally, the roll-in margarine has a rheologic value (determined by a plunger with a diameter of 10 mm Φ , unit: g) of 1700-3500 at 15°C, and about 500-1600 at 20°C. The water-in-oil emulsion composition of the present invention has a rheologic value of greater than or equal to 5000 at 15°C, preferably greater than or equal to 10000, and has a rheologic value of greater than or equal to 2000 at 20°C, preferably greater than or equal to 3500. If the rheologic value is lower, when the roll-in margarine is kneaded with the dough, a poor puffing-up feature of the baked layered wheat flour puffed food is resulted.

[0041] In the aqueous phase, a substance commonly used in producing a water-in-oil emulsion composition can be used, for example, skim milk powder, common salt, flavoring agent, and emulsifying agent.

[0042] Optionally, 1 wt%-10 wt% and preferably 3 wt%-7 wt% of an oxidized starch relative to the water-in-oil emulsion composition is added into the aqueous phase or the oil phase. Oxidized starch is a product made by oxidizing various starches such as corn and potato starches with an oxidant such as hypochlorite, which can be used in

food applications. Accordingly, the baked layered wheat flour puffed food has a wonderful mouth-melting characteristic, and an unprecedented desirable mouthfeel characterized by being fairly crispy.

[0043] The specific process for preparing the plastic water-in-oil emulsion of the present invention includes, for example: adding and dispersing the oxidized starch into the dissolved oil phase component, then mixing the aqueous phase component with the oil phase component containing substantially no trans fatty acid to formulate an emulsion, stirring the oil and aqueous phases warmed to 40°C-50°C by using, for example, a propeller or a homomixer to emulsify them, and then cooling and plasticizing with a well-known kneader in the prior art, such as votator or kombinator, thereby obtaining a plastic water-in-oil emulsion. Furthermore, the oxidized starch may be added into the aqueous phase instead of the oil phase, and then the chill kneading is carried out, thereby obtaining the same plastic water-in-oil emulsion.

[0044] When preparing the plastic water-in-oil emulsion of the present invention, a synthetic emulsifying agent commonly used in the prior art can be used, such as sucrose fatty acid ester, glycerine fatty acid ester, polyglycerine fatty acid ester, sorbitan fatty acid ester, propylene glycol fatty acid ester, and various monoglycerides of organic acids, such as monoglyceride acetate, monoglyceride tartrate, mixed monoglyceride of acetic acid and tartaric acid, monoglyceride citrate, monoglyceride diacetyltartrate, monoglyceride lactate, monoglyceride succinate, and monoglyceride malate. Alternatively, no emulsifying agent is used. The water-in-oil emulsion can be easily obtained when these synthetic emulsifying agent are used.

[0045] In addition to the above substances, the plastic water-in-oil emulsion of the

present invention can further contain, for example, common salt, milk powder, sugar, flavor, or pigment, as desired.

[0046] The plastic water-in-oil emulsion prepared through the above manner is kneaded into the wheat flour during the process of making a dough, so as to formulate a dough in a roughly-kneaded state, which is then shaped and baked, thereby obtaining a layered wheat flour puffed food such as a pie, Danish pastry, and croissant.

[0047] The plastic water-in-oil emulsion of the present invention is especially suitable for making "shortcrust pastry" and "shortcrust puff pastry", and particularly applicable for making "shortcrust puff pastry".

[0048] When being used for making "shortcrust puff pastry", the plastic water-in-oil emulsion of the present invention is shaped into each emulsion with a volume of 15 cc-1500 cc, preferably 30 cc-650 cc, and more preferably 60 cc-200 cc, and the emulsion is preferably cube-, cuboid-, sphere- and cylinder-shaped. If the length of front to back, left to right, and top to bottom are respectively designated with X, Y, and Z, and the longest one of X, Y, and Z is designated with a, and the shortest one is designated with b, the ratio of a/b is preferably equal to or less than 3, preferably equal to or less than 2.5, and more preferably equal to or less than 2.

[0049] Therefore, a sheet-like plastic water-in-oil emulsion can be well dispersed in the puffed dough containing wheat flour. The length of the sheet-like emulsion is 5 mm-50 mm, preferably 10 mm-40 mm, and more preferably 20 mm-30 mm, and the thickness thereof is 2 mm-15 mm, preferably 4 mm-10 mm, and more preferably 5 mm-8 mm.

[0050] If the volume of the plastic water-in-oil emulsion is too small, the oil-and-fat is

excessively kneaded when being stirred and mixed into wheat flour to form a wheat flour dough after a water is added, such that there is no remaining oil-and-fat particles. As a result, the baked product is difficult to render a layered structure, and the mouthfeel sensation is harder and the crisp sensation in the mouth also tends to become worse. If
5 the volume of the plastic water-in-oil emulsion is too large, it is difficult to shape the oil-and-fat into small chips when the oil-and-fat is stirred and mixed into wheat flour to form a wheat flour dough after the water is added, so that the mixing time is longer, and the working efficiency is poorer. What's worse, the un-uniformly mixing problem easily occurs, that is, one part of the oil-and-fat is over kneaded, and another part thereof
10 substantially remains with a large volume, so that the large and small sheets of oil-and-fat coexist. As a result, it is rather difficult to have the oil-and-fat sheet with a uniform size to a certain extent to be dispersed into the dough. Moreover, if such dough is baked, the uniformity of the layers is not desirable, and a certain puffing-up feature cannot be achieved.

15 [0051] Furthermore, examples of the wheat flour include: for example, high gluten flour, semi-high gluten flour, middle gluten flour, and low gluten flour, which can be used alone, or used as a mixture of any two or more than two of the above flours.

[0052] [Embodiments]

[0053] Hereinafter, embodiments of the present invention are provided to further
20 describe the present invention in details. However, the spirits of present invention are not limited to the following embodiments. Particularly, the sequence of adding the additives or the sequence of emulsification, i.e. adding the oil phase into the aqueous phase or adding the aqueous phase into the oil phase, is not limited by the following

examples. Moreover, % and parts in the examples are based on weight.

[0054] [Table 1]

[0055] Formulation and properties of plastic water-in-oil emulsion

	Embodiment 1	Embodiment 2	Embodiment 3	Embodiment 4
Highly Hydrogenated Oil of Palm Kernel Oil	30 (parts)	40	40	0
High-Melting-Point Fraction of Palm Kernel Oil	0	0	0	40
Transesterified Oil of Palm Oil	30	20	20	20
Palm Olein	12	12	12	12
Common Salt	1.0	1.0	1.0	1.0
Lecithin	0.3	0.3	0.3	0.3
EMULSI-MS*	0.4	0.4	0.4	0.4
Oxidized Starch	5	5	0	5
Water	21.3	21.3	26.3	21.3
SFC (10°C)	75	82	82	74
SFC (35°C)	5	6	6	3
Rheologic Value (15°C)**	13000	16000	16000	14000
Rheologic Value (20°C)**	3900	5200	5200	3300
Trans Fatty Acid***	0	0	0	0

*EMULSI-MS: glycerin monostearate (manufactured by Riken Vitamin Co., Ltd.)

5 **Using a plunger of 10 mm Φ , unit: g.

***Percent (%) relative to the total mixture

[0056] [Table 2]

[0057] Formulation and properties of plastic water-in-oil emulsion

	Comparative Embodiment 1	Comparative Embodiment 2	Comparative Embodiment 3
Hardened Soy Bean Oil	30 (parts)	0	0
High-Melting-Point Fraction of Palm Kernel Oil	0	2	60
Transesterified Oil of Palm Oil	30	58	0
Palm Olein	12	12	12
Common Salt	1	1	1
Lecithin	0.3	0.3	0.3
EMULSI-MS*	0.4	0.4	0.4
Oxidized Starch	5	5	5
Water	21.3	22	20
SFC (10°C)	60	70	89
SFC (35°C)	12	15	7
Rheologic Value (15°C)**	3000	1800	22000
Rheologic Value (20°C)**	1100	600	10000
Trans Fatty Acid***	12	0	0

*EMULSI-MS: glycerin monostearate (manufactured by Riken Vitamin Co., Ltd.)

**Using plunger of 10 mm Φ , unit: g.

5 ***Percent (%) relative to the total mixture.

[0058] (Embodiment 1)

[0059] All the raw materials were added and mixed according to the formulation listed in Embodiment 1 in Table 1, and then chill kneaded by a kombinator, to obtain a plastic water-in-oil emulsion. With the plastic water-in-oil emulsion, a shortcrust puff pastry was made by the following preparing process according to the formulation hereinafter (100 parts were set to 2 kg). The plastic water-in-oil emulsion was cut into 40 mm×40 mm×40 mm (with a volume: 64 cc, a/b=1) and warmed to 20°C for being used. In addition, the high-melting-point fraction of palm kernel oil in Table 1 was an

oil having an iodine value of 6 and a melting point of 32°C; and the transesterified oil of palm oil was an oil obtained through a random transesterification of 60% of palm oil with 40% of palm kernel oil. Furthermore, the oxidized starch manufactured by Oji Cornstarch Co., Ltd. was used.

5 [0060] (Formulation)

high gluten flour	70 (parts)
low gluten flour	30 (parts)
common salt	1 (part)
skim milk powder	2 (parts)

10 plastic water-in-oil emulsion	50 (parts)
cold water	42 (parts) (2°C-3°C)

[0061] (Formulating and Baking of Pie Dough)

[0062] (1) Raw materials other than cold water and common salt were added into a 30 quart mixer at a room temperature of 24°C, and mixed for 5 min by a beater at a low rate of 138 rpm, and then 200 g mixed dough was taken out, so as to observe the state of the plastic water-in-oil emulsion. The state of the plastic water-in-oil emulsion was as follows. An elongated emulsion was in the form of a sheet with 20 mm in length and 8 mm in thickness, and a shorter emulsion was in the form of a sheet with 5 mm in length and 2 mm in thickness, and when being observed as a whole, most emulsions were 15 mm in length and 4 mm in thickness. At this time, the temperature of the mixed product was 22°C.

[0063] (2) Next, common salt was dissolved into cold water and added into the above mixed product, and mixed for 1 min by a hook at a low rate of 138 rpm. Thus, a dough

in a roughly-kneaded state for wheat flour puffed food was formulated. The temperature of the kneaded dough was 19°C, and then it was retarded for 30 min at 5°C.

[0064] (3) An operation of folding into four layers at a time was successively implemented twice at a dough temperature of 15°C. Then, the dough was retarded for 5 30 min at 5°C. Next, the dough was rolled out to 2 mm in thickness at a dough temperature of 15°C and then cut into 40 mm×40 mm, and pierced.

[0065] (4) The dough was baked for 12 min at a surface temperature of 190°C and at a bottom temperature of 185°C, and then further baked for 20 min at 100°C.

[0066] Compared with the product using common roll-in margarine (Comparative 10 Embodiment 1), the baked product is chewable, and is a pie with a new mouthfeel characterized by a loose attachment state with better crisp and mouth-melting sensations.

[0067] Furthermore, a pie with less greasy but mild taste that does not exist ever before is made. Moreover, flaking and crumbly phenomena seldom occur and the 15 shape-retentive property is desirable.

[0068] **(Comparative Embodiment 1)**

[0069] All the raw materials were added and mixed according to the formulation listed in Comparative Embodiment 1 in Table 2, and then chill kneaded by a kombinator, so as to obtain a plastic water-in-oil emulsion. With the plastic water-in-oil emulsion, 20 a shortcrust puff pastry was made through the same preparing process according to the same formulation as that in Embodiment 1. However, the cold water was 44 parts.

[0070] The plastic water-in-oil emulsion was cut in the same way as that in Embodiment 1, and used immediately after being taking out from a freezer. The

temperature thereof was 8°C.

[0071] (Formulating and Baking of Pie Dough)

[0072] (1) The operations the same as that of Embodiment 1 were performed, so as to observe the state of the plastic water-in-oil emulsion, and the state thereof was as follows. An elongated emulsion was in the form of a sheet with 10 mm in length and 6 mm in thickness, and a shorter emulsion was in the form of a sheet with 3 mm in length and 1 mm in thickness, and when being observed as a whole, most of the emulsions were 5 mm in length and 3 mm in thickness. At this time, the temperature of the mixed product was 20°C.

10 [0073] (2) A dough in a roughly-kneaded state for wheat flour puffed food was formulated in the same way as that in Embodiment 1, and retarded for 30 min at 5°C. However, the temperature of the kneaded dough was 15°C.

[0074] (3) An operation of folding into four layers at a time was successively implemented twice at a dough temperature of 12°C. Then, the dough was retarded for 15 30 min at 5°C. Next, the dough was rolled out to 2 mm in thickness at a dough temperature of 10°C and cut into 40 mm×40 mm, and pierced.

[0075] (4) The dough was baked in the same way as that in Embodiment 1. The baked product is chewable, and has a shape-retentive property, and it is difficult to be spalled off. However, it has a quite crispy mouthfeel instead of the mouthfeel 20 sensation characterized by a loose attachment state as in Embodiment 1, and the waxy feeling and poor mouth-melting characteristic exist.

[0076] (Embodiment 2)

[0077] All the raw materials were added and mixed according to the formulation

listed in Embodiment 2 in Table 1, and then chill kneaded by a kombinator, so as to obtain a plastic water-in-oil emulsion. With the plastic water-in-oil emulsion, a shortcrust puff pastry was made through the same preparing process according to the same formulation as that in Embodiment 1. The plastic water-in-oil emulsion was cut
5 in the same way as that in Embodiment 1, and warmed to 20°C for being used.

[0078] (Formulating and Baking of Pie Dough)

[0079] (1) The operations the same as that of Embodiment 1 were performed, so as to observe the state of the plastic water-in-oil emulsion, and the state thereof was as follows. An elongated emulsion was in the form of a sheet with 25 mm in length and 9
10 mm in thickness, and a shorter emulsion was in the form of a sheet with 10 mm in length and 2 mm in thickness, and when being observed as a whole, most of the emulsions were 17 mm in length and 4 mm in thickness. At this time, the temperature of the mixed product was 22°C.

[0080] (2) A dough in a roughly-kneaded state for wheat flour puffed food was
15 formulated in the same way as that in Embodiment 1, and retarded for 30 min at 5°C.

[0081] (3) The dough was folded and retarded in the same way as that in Embodiment 1. Next, the dough was rolled out to 2 mm in thickness at a dough temperature of 16°C and cut into 40 mm×40 mm, and pierced.

[0082] (4) The dough was baked in the same way as that in Embodiment 1. Similar
20 to Embodiment 1, the baked product is chewable, and is a pie with a new mouthfeel characterized by a loose attachment state with better crisp and mouth-melting sensations. Furthermore, a pie with less greasy but mild taste that does not exist ever before is made. Moreover, flaking and crumbly phenomena seldom occur and the

shape-retentive property thereof is desirable.

[0083] (Embodiment 3)

[0084] All the raw materials were added and mixed according to the formulation listed in Embodiment 3 in Table 1, and then chill kneaded by a kombinator, so as to
5 obtain a plastic water-in-oil emulsion. With the plastic water-in-oil emulsion, a shortcrust puff pastry was made through the same preparing process according to the same formulation as that of Embodiment 1. The plastic water-in-oil emulsion was cut in the same way as that in Embodiment 1, and warmed to 20°C for being used.

[0085] (Formulating and Baking of Pie Dough)

10 **[0086]** (1) The operations the same as that of Embodiment 1 were performed, so as to observe the state of the plastic water-in-oil emulsion, and the state thereof was as follows. An elongated emulsion was in the form of a sheet with 23 mm in length and 8 mm in thickness, and a shorter emulsion was in the form of a sheet with 9 mm in length and 2 mm in thickness, and when being observed as a whole, most of the emulsions
15 were 15 mm in length and 4 mm in thickness. At this time, the temperature of the mixed product was 22°C.

[0087] (2) A dough in a roughly-kneaded state for wheat flour puffed food was formulated in the same way as that in Embodiment 1, and retarded for 30 min at 5°C.

[0088] (3) An operation of folding into four layers at a time was successively
20 implemented twice at a dough temperature of 16°C, and then the dough was retarded for 30 min at 5°C. Next, the dough was rolled out to 2 mm in thickness at a dough temperature of 16°C and cut into 40 mm×40 mm, and pierced.

[0089] (4) The dough was baked in the same way as that in Embodiment 1. Similar

to Embodiment 1, the baked product is chewable and less greasy, which is a pie with a mild taste. However, compared with Embodiment 2, the crisp and swallowing sensations in mouth tend to become worse. As for the shape-retentive property, flaking and crumbly phenomena seldom occur and the shape-retentive property thereof is
5 desirable.

[0090] (Embodiment 4)

[0091] All the raw materials were added and mixed according to the formulation listed in Embodiment 4 in Table 1, and then chill kneaded by a kombinator, so as to obtain a plastic water-in-oil emulsion. With the plastic water-in-oil emulsion, a
10 shortcrust puff pastry was made through the same preparing process according to the same formulation as that in Embodiment 1. The plastic water-in-oil emulsion was cut in the same way as that in Embodiment 1, and warmed to 20°C for being used.

[0092] (Formulating and Baking of Pie Dough)

[0093] (1) The operations the same as that of Embodiment 1 were performed, so as to
15 observe the state of the plastic water-in-oil emulsion, and the state thereof was as follows. An elongated emulsion was in the form of a sheet with 22 mm in length and 7 mm in thickness, and a shorter emulsion was in the form of a sheet with 8 mm in length and 2 mm in thickness, and when being observed as a whole, most of the emulsions were 14 mm in length and 4 mm in thickness. At this time, the temperature of the
20 mixed product was 21°C.

[0094] (2) A dough in a roughly-kneaded state for wheat flour puffed food was formulated in the same way as that in Embodiment 1, and retarded for 30 min at 5°C. However, the temperature of the kneaded dough was 18°C.

[0095] (3) An operation of folding into four layers at a time was successively implemented twice at a dough temperature of 15°C, and then the dough was retard for 30 min at 5°C. Next, the dough was rolled out to 2 mm in thickness at a dough temperature of 16°C and cut into 40 mm×40 mm, and pierced.

5 [0096] (4) The dough was baked in the same way as that in Embodiment 1. Similar to Embodiment 2, the baked product is chewable, and is a pie with a new mouthfeel characterized by a loose attachment state with better crisp and mouth-melting sensations. Furthermore, a pie with less greasy but mild taste that does not exist ever before is made. Moreover, flaking and crumbly phenomena seldom occur and the
10 shape-retentive property thereof is desirable.

[0097] **(Comparative Embodiment 2)**

[0098] All the raw materials were added and mixed according to the formulation listed in Comparative Embodiment 2 in Table 2, and then chill kneaded by a kombinator, so as to obtain a plastic water-in-oil emulsion. With the plastic water-in-oil emulsion,
15 a shortcrust puff pastry was made through the same preparing process according to the same formulation as that in Embodiment 1. The plastic water-in-oil emulsion was cut in the same way as that in Embodiment 1, and warmed to 20°C for being used.

[0099] **(Formulating and Baking of Pie Dough)**

[00100] (1) The operations the same as that of Embodiment 1 were performed, so as to
20 observe the state of the plastic water-in-oil emulsion, and the state thereof was as follows. An elongated emulsion was in the form of a sheet with 15 mm in length and 5 mm in thickness, and a shorter emulsion was in the form of a sheet with 5 mm in length and 1 mm in thickness, and when being observed as a whole, most of the emulsions

were 12 mm in length and 3 mm in thickness. At this time, the temperature of the mixed product was 21°C.

[00101] (2) A dough in a roughly-kneaded state for wheat flour puffed food was formulated in the same way as that in Embodiment 1, and retarded for 30 min at 5°C.

5 However, the temperature of the kneaded dough was 18°C.

[00102] (3) An operation of folding into four layers at a time was successively implemented twice at a dough temperature of 15°C, and then the dough was retarded for 30 min at 5°C. Next, the dough was rolled out to 2 mm in thickness at a dough temperature of 16°C and cut into 40 mm×40 mm, and pierced.

10 [00103] (4) The dough was baked in the same way as that in Embodiment 1. Compared with Embodiment 2, the baked product has a soft chewing sensation and is un-chewable, and the crisp sensation in mouth is rather poor. Furthermore, the mouth-melting characteristic is poor and the waxy sensation exists. Moreover, few flaking and crumbly phenomena occur, and the shape-retentive property thereof is not
15 desirable.

[00104] (Comparative Embodiment 3)

[00105] All the raw materials were added and mixed according to the formulation listed in Comparative Embodiment 3 in Table 2, and then chill kneaded by a kombinator, so as to obtain a plastic water-in-oil emulsion. With the plastic water-in-oil emulsion,
20 a shortcrust puff pastry was made through the same preparing process according to the same formulation as that in Embodiment 1. The plastic water-in-oil emulsion was cut in the same way as that in Embodiment 1, and warmed to 20°C for being used.

[00106] (Formulating and Baking of Pie Dough)

[00107] (1) The operations the same as that in Embodiment 1 were performed, so as to observe the state of the plastic water-in-oil emulsion, and the state thereof was as follows. An elongated emulsion was in the form of a sheet with 30 mm in length and 12 mm in thickness, and a shorter emulsion was in the form of a sheet with 15 mm in length and 4 mm in thickness, and when being observed as a whole, most of the emulsions were 22 mm in length and 7 mm in thickness. At this time, the temperature of the mixed product was 22°C.

[00108] (2) A dough in a roughly-kneaded state for wheat flour puffed food was formulated in the same way as that in Embodiment 1, and retarded for 30 min at 5°C.

10 However, the temperature of the kneaded dough was 20°C.

[00109] (3) An operation of folding into four layers at a time was successively implemented twice at a dough temperature of 16°C, and then the dough was retarded for 30 min at 5°C. Next, the dough was rolled out to 2 mm in thickness at a dough temperature of 18°C and cut into 40 mm×40 mm, and pierced.

15 [00110] (4) The dough was baked in the same way as that in Embodiment 1. Compared with Embodiment 2, large oil-and-fat particles were remained till the end of the mixing process, so that the oil-and-fat particles cannot be fully extended during the extension process, and cannot be turned into layered structures sufficiently. The baked product was rapidly de-oiled, and pored, and the common layered pie cannot be
20 obtained.

[00111] (Embodiment 5)

[00112] With the plastic water-in-oil emulsion in Embodiment 2, a shortcrust pastry was made through the following preparing process according to the same formulation as

that in Embodiment 1. The plastic water-in-oil emulsion was cut in the same way as that in Embodiment 1, and warmed to 20°C for being used.

[00113] (Formulating and Baking of Pie Dough)

[00114] (1) Raw materials other than cold water and common salt were added into a 30
5 quart mixer at a room temperature of 24.5°C, and mixed for 8 min by a beater at a low rate of 138 rpm, and then 200 g mixed dough was taken out, so as to observe the state of the plastic water-in-oil emulsion. The state of the plastic water-in-oil emulsion was in a form of finely dried fish-meat floss with an overall diameter of 3 mm-4 mm. At this time, the temperature of the mixed product was 23°C.

10 [00115] (2) Next, common salt was dissolved into cold water and added into the above mixed product, and mixed for 1 min by a hook at a low rate of 138 rpm. A dough in a roughly-kneaded state for wheat flour puffed food was formulated and retarded for 30 min at 5°C. The temperature of the kneaded dough was 20°C.

[00116] (3) The dough was rolled out to 1.7 mm in thickness at a dough temperature of
15 18°C, and pierced. Next, the dough was cut by a trimming die of 50 mm Φ, and arranged on a board.

[00117] (4) The dough was baked for 9 min at a surface temperature of 190°C and a bottom temperature of 185°C, and then further baked for 10 min at 100°C.

[00118] Compared with a product using a common roll-in margarine (Comparative
20 Embodiment 4), the baked product has better puffing-up sensation, and is chewable, which is a pie with a new mouthfeel characterized by a loose attachment state with better crisp and mouth-melting sensations.

[00119] Furthermore, a pie with less greasy but mild taste that does not exist ever

before is made. Moreover, flaking and crumbly phenomena seldom occur and the shape-retentive property thereof is desirable.

[00120] (Comparative Embodiment 4)

5 [00121] With the plastic water-in-oil emulsion in Comparative Embodiment 1, a shortcrust pastry was made according to the same formulation and preparing process as that in Embodiment 5. The plastic water-in-oil emulsion was cut in the same way as that in Embodiment 1, and warmed to 20°C for being used.

[00122] (Formulating and Baking of Pie Dough)

10 [00123] (1) Raw materials other than cold water and common salt were added into a 30 quart mixer at a room temperature of 24°C, and mixed for 7 min by a beater at a low rate of 138 rpm, and then 200 g mixed dough was taken out, so as to observe the state of the plastic water-in-oil emulsion. The state of the plastic water-in-oil emulsion was in a form of finely dried fish-meat floss with an overall diameter of 3 mm-4 mm. At this time, the temperature of the mixed product was 23°C.

15 [00124] (2) Next, common salt was dissolved into cold water and added into the above mixed product, and mixed for 1 min by a hook at a low rate of 138 rpm. A dough in a roughly-kneaded state for wheat flour puffed food was formulated and retarded for 30 min at 5°C. The temperature of the kneaded dough was 20°C.

20 [00125] (3) The dough was rolled out to 1.7 mm in thickness at a dough temperature of 18°C, and pierced. Next, the dough was cut by a trimming die of 50 mm Φ , and arranged on a board.

[00126] (4) The dough was baked for 9 min at a surface temperature of 190°C and a bottom temperature of 185°C, and then further baked for 10 min at 100°C.

[00127] The baked product is chewable and difficult to be spalled off, and thus has a desirable shape-retentive property. However, the baked product has a poor puffing-up performance and a compact internal structure, and produces dry and hard mouthfeel, which is a greasy pie with poor crisp and mouth-melting characteristics.

5 **[00128] (Shape-retentive Strength Test of Baked Pie Product)**

[00129] For Embodiments 1-4 and Comparative Embodiments 1-2, the baked product was placed into a hexangular container (cylindrical container made of styrene) of 90 mm Φ , and suspended in a Multi Shaker (MMS, manufactured by TOKYO RIKAKIKAI CO., LTD.), stirred for 1 min at a rate of 215 rpm, and then a damage state of the baked
10 pie product is observed. In Embodiments 1 and 2, the product is less damaged and has a desirable shape-retentive property. In Embodiments 3, 4, and Comparative Embodiment 1, the product is damaged, but the damage thereof is within the acceptable range without causing problems. In Comparative Embodiment 2, the product is damaged so seriously that the value of the product is impacted.

15 **[00130] (Sensory Evaluation of Baked Product)**

[00131] Evaluations on mouthfeel sensation, waxy sensation, greasy sensation, crisp sensation, and mouth-melting sensation are carried out.

[00132] (Embodiments 1-4)

[00133] Mouthfeel sensation (crisp sensation), mouth-melting sensation, and
20 swallowing sensation are all desirable. However, Embodiment 2 has slightly better sensations than that in Embodiment 3. Neither waxy sensation nor greasy sensation is felt.

[00134] (Comparative Embodiments 1-3)

[00135] In Comparative Embodiments 1-2, the mouthfeel sensation, waxy sensation, greasy sensation, crisp sensation, and mouth-melting sensation have certain problems. In Comparative Embodiment 1, the shape-retentive property has no problems, but the content of the trans fatty acid is 12%. In Comparative Embodiment 3, it has an excessively high hardness, and thus lacks of extendibility as a plastic oil-and-fat, which cannot be used. The results of Embodiments 1-4 and Comparative Embodiments 1-3 are summarized in Table 3, in which ◎: quite good, ○: good, △: slightly poor, ×: poor.

[00136] [Table 3]

[00137] Sensory Evaluation of Baked Product

	Embodiment 1	Embodiment 2	Embodiment 3	Embodiment 4
Shape-retentive Property	◎	◎	○	○
Mouthfeel Sensation (Crisp Sensation)	○	○	△	○
Waxy Sensation, Greasy Sensation	○	○	○	○
Mouth-Melting Sensation, Swallowing Sensation	○	○	△	○
Content of Trans Fatty Acid (%)	0	0	0	0

10

	Comparative Embodiment 1	Comparative Embodiment 2	Comparative Embodiment 3
Shape-retentive Property	○	×	-
Mouthfeel Sensation (Crisp Sensation)	×	×	-
Waxy Sensation, Greasy Sensation	×	×	-
Mouth-Melting Sensation, Swallowing Sensation	×	×	-
Content of Trans Fatty Acid (%)	12	0	0

[00138] It will be apparent to those skilled in the art that various modifications and

variations can be made to the structure of the present invention without departing from the scope or spirit of the invention. In view of the foregoing, it is intended that the present invention cover modifications and variations of this invention provided they fall within the scope of the following claims and their equivalents.

WHAT IS CLAIMED IS:

1. A plastic water-in-oil emulsion for a layered wheat flour puffed food, comprising: 10 wt%-50 wt% of a hard oil-and-fat mainly composed of lauric acid, wherein an oil phase has an SFC value of 50 or greater at 10°C, and 10 or less at 35°C.
- 5 2. The plastic water-in-oil emulsion for a layered wheat flour puffed food according to claim 1, wherein the plastic water-in-oil emulsion substantially contains no trans fatty acid.
3. The plastic water-in-oil emulsion for a layered wheat flour puffed food according to claim 1, wherein the plastic water-in-oil emulsion contains 1 wt%-10 wt%
10 of an oxidized starch.
4. A method for making a dough for a layered wheat flour puffed food, comprising: mixing and stirring the plastic water-in-oil emulsion for a layered wheat flour puffed food according to claims 1 to 3 shaped with a volume of 15 cc-1500 cc and a wheat flour.
- 15 5. A layered wheat flour puffed food, wherein the layered wheat flour puffed food is obtained by baking the dough for the layered wheat flour puffed food according to claim 4.