

DESCRIPTION

TITLE OF INVENTION: CHEESE-LIKE FOOD AND METHOD FOR PRODUCING CHEESE-LIKE FOOD

TECHNICAL FIELD

[0001]

The present invention relates to a plant-based cheese-like food with a cheese-like texture and a method for producing the same.

BACKGROUND ART

[0002]

Demand for cheese has been increasing year by year due to its diverse cooking methods and unique flavor, and currently, diverse cheeses are being produced using a variety of ingredients and production methods to meet this demand. At the same time, there has been a noticeable trend toward avoiding animal-based foods due to the worsening health problems such as obesity and diabetes, growing health consciousness, production cost reduction, and veganism.

[0003]

In this context, interest has been building in the production of analog cheeses that use less or no raw cheese at all.

Analog cheese generally refers to a food similar to cheese, produced using plant-based ingredients such as rice, yeast, vegetable fats and oils, and starch. In recent years, attempts have been made to use plant-based proteins as substitutes for animal-based proteins, thereby enhancing the nutritional value of analog cheeses.

[0004]

Typically, potato-derived processed starch is often used in the production of analog cheese. The texture of analog cheeses using potato-derived processed starch is crumbly and mealy, very far from the elasticity of cheese. Many products on the market use hydroxypropylated starch to impart smoothness and melting properties (stringiness)

when heated and melted, but have poor elasticity for cheese.

Furthermore, no analog cheeses on the domestic market contain 3% or more plant-based protein, and the use of plant-based protein results in an even more crumbly and mealy texture.

[0005]

Patent Document 1 discloses that by setting the mass ratio of starch to water to between 0.55 and 0.92, inclusive, and the mass ratio of fat to starch to between 0.25 and 1.80, inclusive, it is possible to improve the productivity of cheese-like foods while imparting an appropriate texture to the cheese-like foods. However, the cheese-like foods do not comprise plant-based protein.

[0006]

Patent Document 2 discloses a plant-based cheese-like food that, by blending a specific soy protein material into the cheese-like food, has a melty texture and milky taste similar to natural cheese and is suitable for processing into shreds, etc. However, the plant-based cheese-like food has a relatively low plant-based protein content of 1.5 to 2.5% or less. Furthermore, because this plant-based cheese-like food is intended to be eaten after being heated and melted, it is unclear whether it sufficiently possesses the elasticity expected of cheese intended to be eaten as is.

PRIOR ART DOCUMENTS

PATENT DOCUMENTS

[0007]

Patent Document 1: JP2022-60294A

Patent Document 2: WO2018/173610

SUMMARY OF INVENTION

TECHNICAL PROBLEM

[0008]

As described above, conventional technologies have had the problem that it is

difficult to achieve both nutritional value required of a food and a pleasant cheese-like texture when eaten. Thus, the present invention aims to provide a plant-based cheese-like food that contains plant-based protein, possesses the nutritional value required of a food, and exhibits a cheese-like texture, and a method for producing the same.

SOLUTION TO PROBLEM

[0009]

As a result of intensive research, the present inventors have found that a cheese-like food in which the mass ratio of the total mass of starch and plant-based protein to water is between 0.40 and 0.80, inclusive and the mass ratio of plant-based protein to fats and oils is between 0.10 and 0.55, inclusive, has a cheese-like texture even when it contains plant-based protein, and they have thus completed the cheese-like food of the present invention and a method for producing the same.

That is, the present invention includes the following features.

[1] A cheese-like food comprising starch, water, an emulsifier, fats and oils, and a plant-based protein, wherein the mass ratio of the total mass of the starch and the plant-based protein to the water is 0.40 or more and 0.80 or less, and the mass ratio of the plant-based protein to the fats and oils is 0.10 or more and 0.55 or less.

[2] The cheese-like food of [1], wherein the starch comprises at least one of hydroxypropylated starch, hydroxypropyl distarch phosphate, and acetylated distarch adipate, and the mass ratio of the total mass thereof to the starch is 0.10 or more and 0.60 or less.

[3] The cheese-like food of [1] or [2], wherein the cheese-like food comprises at least 3 mass% of the plant-based protein.

[4] The cheese-like food of [1] or [2], wherein the emulsifier comprises starch sodium octenyl succinate.

[5] The cheese-like food of [1] or [2], wherein the plant-based protein is a pea-derived protein.

[6] The cheese-like food of [1] or [2], wherein the cheese-like food is an individually packaged portion-type food.

[7] A method for producing a cheese-like food, comprising: preparing a mixture comprising starch, water, an emulsifier, fats and oils, and plant-based protein; and stirring the mixture while heating, wherein the mass ratio of the total mass of the starch and the plant-based protein to the water is 0.40 or more and 0.80 or less, and the mass ratio of the plant-based protein to the fats and oil is 0.10 or more and 0.55 or less.

[8] The method for producing a cheese-like food of [7], wherein the starch comprises at least one of hydroxypropylated starch, hydroxypropyl distarch phosphate, and acetylated distarch adipate, and the mass ratio of the total mass thereof to the starch is 0.10 or more and 0.60 or less.

[9] The method for producing a cheese-like food of [7] or [8], wherein the cheese-like food comprises at least 3 mass% of the plant-based protein.

[10] The method for producing a cheese-like food of [7] or [8], wherein the emulsifier comprises starch sodium octenyl succinate.

[11] The method for producing a cheese-like food of [7] or [8], wherein the plant-based protein is a pea-derived protein.

ADVANTAGEOUS EFFECTS OF INVENTION

[0010]

According to the present invention, a cheese-like food that contains plant-based protein but exhibits a cheese-like texture, and a method for producing the same, are provided.

DESCRIPTION OF EMBODIMENTS

[0011]

A cheese-like food of the present invention will now be described in further detail. Unless otherwise specified, percentages are based on the total mass of the cheese-like food.

[0012]

The cheese-like food of the present invention comprises starch, water, an emulsifier, fats and oils, and plant-based protein, and the mass ratio of the total mass of the starch and the plant-based protein to the water is between 0.40 and 0.80, inclusive, and the mass ratio of the plant-based protein to the fats and oils is between 0.10 and 0.55, inclusive. This configuration makes it possible to impart a texture similar to that of processed cheese made from milk (hereinafter sometimes referred to simply as processed cheese) to a cheese-like food containing plant-based protein.

Furthermore, the cheese-like food of the present invention can further approximate the texture of processed cheese by comprising, as the starch, at least one of hydroxypropylated starch, hydroxypropyl distarch phosphate, and acetylated distarch adipate.

[0013]

[Plant-Based Protein]

The cheese-like food of the present invention comprises plant-based protein. From the standpoint of nutritional enrichment, the plant-based protein content is preferably 3 mass% or more and less than 15 mass%, and even more preferably 5 mass% or more and 10 mass% or less. As the plant-based protein content increases, the cheese-like food is more crumbly and mealy. By adjusting the blending ratio of the ingredients as described above, the cheese-like food of the present invention can have a cheese-like texture even with a high plant-based protein content (3% or more). Furthermore, the mass ratio of plant-based protein to fats and oils is preferably 0.10 to 0.55, inclusive, more preferably 0.12 to 0.50, inclusive, and even more preferably 0.13 to 0.45, inclusive. When the mass ratio of plant-based protein to fats and oils is greater than 0.55, the oil and solids in the cheese-like food tend to separate, and when it is less than 0.10, the cheese-like food tends to be hard. The plant-based protein used in the present invention may be derived from, for example, pea, soybean, edamame, etc., but is not limited thereto.

The cheese-like food of the present invention may comprise animal-based protein.

However, to maximize the benefits of the present invention, it is preferable to avoid inclusion of animal-based protein. This is because the present invention minimizes immergence of the crumbly and mealy texture that results from the use of plant-based protein as a substitute for milk-derived animal-based protein, and enables the production of a cheese-like food that overcomes all of the problems associated with the use of animal ingredients, nutrition, and texture.

[0014]

[Starch]

In the cheese-like food of the present invention, the mass ratio of the total mass of starch and plant-based protein to water is preferably 0.40 to 0.80, inclusive, more preferably 0.45 to 0.80, inclusive, and even more preferably 0.48 to 0.77, inclusive. When the mass ratio of the total mass of starch and plant-based protein to water exceeds 0.80, the cheese-like food tends to be brittle, and when it is less than 0.40, the cheese-like food tends to be soft.

[0015]

The cheese-like food of the present invention preferably comprises, as starch, at least one of hydroxypropylated starch, hydroxypropyl distarch phosphate, and acetylated distarch adipate. More preferably, it comprises at least one of hydroxypropyl distarch phosphate and acetylated distarch adipate. The at least one of hydroxypropylated starch, hydroxypropyl distarch phosphate, and acetylated distarch adipate can impart cheese-like elasticity and texture to the cheese-like food. The mass ratio of the total mass of hydroxypropylated starch, hydroxypropyl distarch phosphate, and acetylated distarch adipate to the total mass of starch is preferably 0.10 to 0.60, inclusive, more preferably 0.10 to 0.55, inclusive, and even more preferably 0.13 to 0.50, inclusive.

[0016]

Hydroxypropylated starch, hydroxypropyl distarch phosphate, and acetylated distarch adipate can change the texture of a cheese-like food or impart functionality to the

cheese-like food. Here, changes in the texture of the cheese-like food include, for example, softening, hardening, smoothness, increased elasticity, etc., and functionality imparted to the cheese-like food includes, for example, aging resistance, water retention, etc. The combination and respective contents of hydroxypropylated starch, hydroxypropyl distarch phosphate, and acetylated distarch adipate contained in the cheese-like food can be appropriately adjusted in view of the desired texture, functionality, etc. of the cheese-like food.

[0017]

Hydroxypropyl distarch phosphate can suppress syneresis in cheese-like foods and make them smooth. Hydroxypropylated starch can impart functionality such as water retention and aging inhibition to cheese-like foods.

[0018]

Other starches include, but are not limited to, modified starches such as oxidized starch, acetylated starch, acetylated oxidized starch, and acetate starch. In the cheese-like foods of the present invention, it is preferable to use, for example, oxidized starch, and its content is preferably, for example, 10 mass% or more and 23 mass% or less.

[0019]

Modified starch can be obtained by processing raw starch. Examples of raw starch include potato starch, tapioca starch, waxy corn starch, corn starch, high-amylose corn starch, sweet potato starch, wheat starch, rice starch, and sago starch, but the raw starch used for the cheese-like foods of the present invention is not limited thereto. The raw starch may be used alone or in combination of two or more.

The starch content of the cheese-like food of the present invention can be adjusted appropriately in view of the mass ratio of the total mass of starch and plant-based protein to water, as described above, but is preferably, for example, 10 mass% or more and 30 mass% or less.

[0020]

[Fats and Oils]

The fats and oils contained in the cheese-like food of the present invention are plant-based oils, such as palm oil, palm kernel oil, coconut oil, soybean oil, rapeseed oil, corn oil, cottonseed oil, rice bran oil, sunflower oil, safflower oil, sesame oil, olive oil, and processed fats and oils obtained by subjecting these oils to interesterification, hydrogenation, fractionation, hardening, etc., but are not limited thereto. These edible fats and oils may be used alone or in combination of two or more. In the cheese-like food of the present invention, rapeseed oil is preferably used, and its content is preferably, for example, 15 mass% or more and 35 mass% or less.

[0021]

[Water]

As used herein, "water" refers to raw material water (blended water) added during the production of the cheese-like food, and does not include moisture originally contained in other raw materials such as starch and protein. The amount of "water" in the cheese-like food of the present invention can be adjusted appropriately in view of the mass ratio of the total mass of starch and plant-based protein to "water," but is preferably, for example, 25 mass% or more and less than 60 mass%.

[0022]

Note that "water" in the cheese-like food of the present invention may be other than water. For example, plant-based emulsions such as soy milk, coconut milk, almond milk, and rice milk, vegetable juice, fruit juice, etc. may be used as "water". A liquid other than water can impart the flavor of the liquid to the cheese-like food.

[0023]

[Emulsifier]

The cheese-like food of the present invention comprises an emulsifier. Examples of emulsifiers include, but are not limited to, lecithin, monoglycerin fatty acid esters, organic acid mono-fatty acid glycerides, polyglycerin fatty acid esters, polyglycerin

condensed ricinoleate esters, propylene glycol fatty acid esters, sorbitan fatty acid esters, sucrose fatty acid esters, polyoxyethylene sorbitan fatty acid esters, and starch sodium octenyl succinate. In the cheese-like food of the present invention, starch sodium octenyl succinate is preferably used, for example, in an amount of 1 mass% or more and 5 mass% or less.

[0024]

Note that, in this specification, starch sodium octenyl succinate is treated as an emulsifier rather than as starch. Accordingly, in this specification, the content of starch sodium octenyl succinate is not included in the total amount of starch.

[0025]

[Other Ingredients]

The cheese-like food of the present invention may comprise ingredients other than the above ingredients, as long as they do not impair the effects of the present invention. Examples of other ingredients include, but are not limited to, antioxidants, seasonings, polysaccharides, pH adjusters, preservatives, and coloring agents. Specific examples of antioxidants include L-ascorbic acid, L-ascorbic acid derivatives, tocopherol, tocotrienol, lignans, ubiquinones, xanthines, oryzanol, catechins, and polyphenols. Specific examples of seasonings include flavorings, salt, sugar, and amino acids. Specific examples of polysaccharides include starch other than those mentioned above, xanthan gum, guar gum, gum arabic, pectin, locust bean gum, carrageenan, alginic acid, dextrin, gellan gum, and cellulose. pH adjusters include acetic acid, phosphoric acid, citric acid, lactic acid, and sodium salts thereof.

[0026]

The cheese-like food of the present invention may be individually packaged. The cheese-like food of the present invention may be, for example, an individually packaged whole cheese-like food or an individually packaged portion-type cheese-like food. Packaging materials commonly used for food packaging, such as aluminum film, plastic

film, and wrapping paper, can be used for the individual packaging.

[0027]

As used herein, "individually packaged" means that each unit of product is individually packaged. For example, a single candy individually wrapped in a packaging material is an "individually packaged" candy. Individual packaging of the cheese-like food of the present invention can be performed from the perspective of preventing deterioration in the quality of the cheese-like food and ease of handling when consuming it.

[0028]

The cheese-like food of the present invention has physical properties and a flavor similar to those of processed cheese that is consumed as is without heating. Therefore, the cheese-like food of the present invention is preferably in a shape such as a portion type or a block type that can be cut and eaten. However, the shape is not limited thereto, and any other shape or form, such as a sliced type, a diced type, or a shredded type, is also acceptable.

[0029]

A method for producing a cheese-like food of the present invention will then be described in detail.

[0030]

[Method for Producing Cheese-Like Food]

The cheese-like food of the present invention can be produced by a production method comprising the steps of: preparing a mixture comprising starch, water, an emulsifier, fats and oils, and plant-based protein; and stirring the mixture while heating, wherein the mass ratio of the total mass of the starch and the plant-based protein to the water is 0.40 to 0.80, inclusive, and the mass ratio of the plant-based protein to the fats and oils is 0.10 to 0.55, inclusive.

[0031]

[Step of Preparing Mixture]

This step is a step of preparing a mixture comprising starch, water, an emulsifier, fats and oils, and plant-based protein. In this step, the mass ratio of the total mass of starch and plant-based protein to water is preferably 0.40 to 0.80, inclusive, more preferably 0.45 to 0.80, inclusive, and even more preferably 0.48 to 0.77, inclusive. Furthermore, the mass ratio of plant-based protein to fats and oils is preferably 0.10 to 0.55, inclusive, more preferably 0.12 to 0.50, inclusive, and even more preferably 0.13 to 0.45, inclusive. Each ingredient is weighed and charged into an emulsification apparatus. When preparing the mixture, the ingredients may be mixed together, or any two ingredients may be premixed and then the remaining ingredients may be added and mixed.

[0032]

[Step of Stirring While Heating]

This step is a step of heating and stirring the mixture of ingredients charged into the emulsification apparatus. In the method for producing a cheese-like food of the present invention, heating and stirring can be performed, for example, by stirring at 500 to 1500 rpm while heating, and after the mixture temperature reaches 80 °C or higher, further stirring at 500 to 1500 rpm while maintaining the temperature at 80 °C or higher. Furthermore, conditions such as heating temperature, stirring speed, and stirring time can be appropriately changed in view of the size of the emulsification apparatus and the blending ratio of the ingredients, as long as the mixture is sufficiently heated and emulsified. The emulsification apparatus may be a vertical shear emulsifier, a kettle emulsifier, a Stephan emulsifier, a scraper emulsifier, or any other emulsification apparatus commonly used in emulsifying processed cheese.

[0033]

[Cooling Step]

This step is a step of cooling and solidifying the emulsified mixture. For example, cooling can be performed in an atmosphere above 0 °C and up to 10 °C. Cooling

within this temperature range can impart an appropriate hardness to the emulsified mixture.

[0034]

[Packaging Step]

This step is a step of packaging the emulsified mixture. In the present invention, the packaging step may be performed before or after the cooling step. That is, in the case of a portioned cheese-like food, the mixture may be cooled and solidified, then cut into portion-sized pieces and packaged, or the uncooled mixture may be filled into individual portion-sized packages and then cooled. Individual packaging of portioned cheese-like foods may be performed under the same conditions as individual packaging of ordinary portioned processed cheese, such as by ensuring that the packaging material adheres tightly to the cut surfaces. Furthermore, individual packaging of portion-type cheese-like foods can be carried out using a packaging machine used for individual packaging of ordinary portion-type processed cheese.

[0035]

[Evaluation Method]

The cheese-like food of the present invention can be evaluated by hardness, chewability, brittleness, surface roughness, and sensory evaluation. Examples of evaluation methods for these items are given below.

1. Hardness and Chewability

The "hardness" and "chewability" of the cheese-like food can be evaluated by adjusting the temperature of the cheese-like food to 10 °C, cutting it into 10 x 10 x 10 mm cubes, and measuring the cut blocks using a texture analyzer (product name: TA.XT.plus, manufacturer: Eiko Seiki Co., Ltd.) according to evaluation criteria based on the measured values of commercially available processed cheese. "Hardness" is defined as the area in the positive direction of the first compression, and the value representing "chewability" is calculated by multiplying the measurements of "hardness," "cohesiveness," and "elasticity."

2. Brittleness

The "brittleness" of a cheese-like food can be measured using a texture analyzer (product name: TA-XT2i, manufacturer: Eiko Seiki Co., Ltd.) and evaluated according to evaluation criteria based on the measured values of commercially available processed cheese. A jig is contacted with the center of a fixed test specimen and lowered from contact at a speed of 0.33 mm/s, and the distance the jig descends until the cheese-like food breaks is defined as the brittleness.

3. Surface Roughness

The "surface roughness" of a cheese-like food can be evaluated by measuring the arithmetic mean height Ra (the plane at the average height of all data within the observation field is used as the reference plane, and the absolute values of the differences between the height of each point and the height of the reference plane are averaged) using a shape measuring laser microscope (product name: VK-9710, manufacturer: Keyence Corporation) on the cross section of the test specimen broken in the measurement of [2. Brittleness] above, and evaluating according to evaluation criteria based on the measured values of commercially available processed cheese.

4. Sensory Evaluation

In the "sensory evaluation" of cheese-like foods, five trained panelists blindly taste the cheese-like foods and rate them on a 10-point scale, with 10 being "preferable" and 1 being "unfavorable," based on whether the texture is similar to that of commercially available processed cheese. The average score of the five panelists is used for the evaluation.

EXAMPLES

[0036]

Examples of the present invention will be described in detail below, but the present invention is not limited thereto and various improvements can be made based on known techniques. Unless otherwise specified, percentages are based on the total weight of the cheese-like food.

[0037]

[Examples 1 to 8, Comparative Examples 1 to 3]

Cheese-like foods with different blending ratios of the ingredients were produced, and their physical properties and flavors were evaluated. Example Products 1 to 8 and Comparative Products 1 to 3 were produced by the following manufacturing method.

[0038]

Plant-based protein, starch, oil, emulsifier, water, and seasoning were prepared, and each ingredient was weighed and charged into a tabletop cutter mixer (product name: THERMO MIX, manufacturer: VORWERK) and stirred at 500 rpm for 5 minutes. The temperature of the tabletop cutter mixer was then set to 95 °C, and the mixture was emulsified by stirring at 1500 rpm for 20 minutes. At this time, the temperature of the mixture was 85 °C or higher. The emulsified mixture was filled into a 0.07 mm thick nylon vacuum bag (400 mm×280 mm) and cooled at 5 °C for 1 day. It was then refrigerated at 10 °C for 7 days and evaluated.

[0039]

The blending ratios of the ingredients are shown in Table 1.

In Example 1, the ingredients were weighed and charged into the tabletop cutter mixer so that the cheese-like food comprised 3% pea-derived protein, 20.3% potato oxidized starch, 23.0% rapeseed oil, 3.7% potato starch sodium octenyl succinate, 49.0% water, and 1.0% seasoning. The procedure described above was then carried out to produce Example Product 1.

[0040]

[Examples 9-12]

Cheese-like foods were produced by replacing part or all of the tapioca hydroxypropyl distarch phosphate used in Example 8 with tapioca hydroxypropylated starch, waxy hydroxypropyl distarch phosphate, corn hydroxypropyl distarch phosphate, or tapioca acetylated distarch adipate, and the physical properties and sensory evaluations

were performed. The blending ratios of the ingredients of the cheese-like foods for Example Products 9 to 12 are shown in Table 2.

[0041]

[Test Example 1] Evaluation of Hardness and Chewability

The hardness and chewability of the cheese-like foods of the present invention were measured as follows.

Example products 1 to 12, Comparative Example products 1 to 3, and a commercially available processed cheese (trade name: "Snow Brand Baby Cheese", manufacturer: MEGMILK SNOW BRAND Co., Ltd.; the same applies to the following Test Examples) were adjusted to 10 °C and then cut into 10×10×10 mm cubic blocks, and the cut blocks were measured using a texture analyzer (trade name: TA.XT.plus, manufacturer: Eiko Seiki Co., Ltd.). "Hardness" was defined as the area in the positive direction of the first compression, and the value representing "chewability" was calculated by multiplying the measured values of "hardness," "cohesiveness," and "elasticity." Measurements were carried out under the condition of the following parameters.

<Texture Analyzer Parameters>

Penetration speed: 0.5 mm/sec

Contact confirmation (trigger force): 0.06 N

Distortion rate: 80% load

Cycle: 2

(Hardness Evaluation Criteria)

The evaluation criteria, based on the measured values of commercially available processed cheese, were as follows. The symbol "×" represents failure. The results are shown in Tables 1 and 2.

◎: 120 N·sec or more and less than 220 N·sec

○: 100 N·sec or more and less than 120 N·sec, or 220 N·sec or more and less than 300 N·sec

×: less than 100 N·sec, or 300 N·sec or more

(Chewability Evaluation Criteria)

The evaluation criteria, based on the measured values of commercially available processed cheese, were as follows. The symbol "×" represents failure. The results are shown in Tables 1 and 2.

⊙: 7 N·sec or more and less than 15 N·sec

○: 3 N·sec or more and less than 7 N·sec, or 15 N·sec or more and less than 25 N·sec

×: less than 3 N·sec

[0042]

[Test Example 2] Evaluation of Brittleness

The brittleness of the cheese-like foods of the present invention was measured as follows.

Example products 1 to 12, Comparative Example products 1 to 3, and commercially available processed cheese were held at 10 °C for 30 minutes or more before measurement, and the brittleness was measured using the texture analyzer (product name: TA-XT2i, manufacturer: Eiko Seiki Co., Ltd.) according to the following procedure. Example products 1 to 12, Comparative Example products 1 to 3, and a commercially available processed cheese were cut into pieces 35 mm wide×15 mm thick×10 mm high. The cut specimens were placed horizontally on two supports (90 mm wide, 5 mm thick, 32 mm high) spaced 25 mm apart, without being fixed in alignment with the edges. A jig (90 mm wide, 5 mm thick, 13 mm high, with a semicircular tip 5 mm in diameter) was placed on top of the specimen and brought into contact with the center of the specimen. The jig was lowered at a speed of 0.33 mm/s, and the distance the jig descended until the cheese broke was measured. The distance until the cheese broke was defined as brittleness. The evaluation criteria, based on the measured values of commercially available processed cheese, were as follows. The symbol "×" represents failure. The results are shown in

Tables 1 and 2.

(Evaluation Criteria)

◎: 5 mm or more

○: 3 mm or more and less than 5 mm

×: less than 3 mm

[0043]

[Test Example 3] Evaluation of Surface Roughness

The surface roughness of the cheese-like foods of the present invention was measured as follows.

For Example products 1 to 12, Comparative Example products 1 to 3, and a commercially available processed cheese, the cross sections of test specimens broken in the brittleness measurement in [Test Example 2] were measured for arithmetic mean height Ra (the plane of the average height of all data within the observation field was used as the reference plane, and the absolute values of the differences in height between each point and the height of the reference plane were averaged) using a shape measuring laser microscope (product name: VK-9710, manufacturer: Keyence Corporation). The evaluation criteria, based on the measured values of commercially available processed cheese, were as follows. The symbol "×" represents failure. The results are shown in Tables 1 and 2.

(Evaluation Criteria)

◎: less than 50 μm

○: 50 μm or more and less than 100 μm

×: 100 μm or more

[0044]

[Test Example 4] Sensory Evaluation

Sensory evaluation of the cheese-like food of the present invention was carried out as follows.

For Example products 1 to 12, Comparative Example products 1 to 3, and a

commercially available processed cheese, blind sensory evaluation was carried out with five trained panelists. The samples were scored on a 10-point scale, with 10 points being favorable and 1 point being unfavorable, regarding whether the texture was similar to that of commercially available processed cheese, and were evaluated using the average scores of the five trained panelists. The symbol "×" represents failure. The results are shown in Tables 1 and 2.

⊙: (8-10 points): Similar to commercially available processed cheese in texture and favorable.

○: (5-7 points): Different from commercially available processed cheese in texture, but acceptable with no problems in flavor and texture.

×: (1-4 points): Significantly different from commercially available processed cheese, with poor texture such as syneresis and oil-off.

[0045]

[Table 1]

		Processed Cheese	Comparative Example 1	Comparative Example 2	Comparative Example 3	Example 1	Example 2	Example 3	Example 4	Example 5	Example 6	Example 7	Example 8
Fats and oils	rapeseed oil (%)	-	20.0	22.0	22.0	23.0	35.0	15.0	28.0	22.0	22.0	23.0	23.0
Starch	potato oxidized starch (%)	-	8.3	5.0	22.4	20.3	17.4	17.4	17.4	17.4	17.4	18.3	10.0
Emulsifier	potato starch sodium octenyl succinate (%)	-	1.7	3.0	4.6	3.7	3.6	3.6	3.6	3.6	3.6	3.7	2.0
Emulsifier	waxy starch sodium octenyl succinate (%)	-	-	-	-	-	-	-	-	-	-	-	1.5
Starch	tapioca hydroxypropyl distarch phosphate (%)	-	4.5	4.5	4.5	-	4.5	4.5	4.5	4.5	4.5	2.0	12.0
Plant-based protein	pea-derived protein (%)	-	5	15	-	3	5	5	5	3	10	3	3
	seasonings (salt, flavorings) (%)	-	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
	water (%)	-	59.5	49.5	45.5	49.0	33.5	53.5	40.5	48.5	41.5	49.0	47.5
	total (%)	-	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
	mass ratio of the total mass of starch and protein to water	-	0.30	0.49	0.59	0.48	0.80	0.50	0.66	0.51	0.77	0.48	0.53
	mass ratio of plant-based protein to fats and oils	-	0.25	0.68	-	0.13	0.14	0.33	0.18	0.14	0.45	0.13	0.13
	mass ratio of total mass of hydroxypropylated starch, hydroxypropyl distarch phosphate, and acetylated distarch adipate to starch	-	0.35	0.47	0.17	-	0.21	0.21	0.21	0.21	0.21	0.10	0.55
	Hardness	☉	x	x	x	☉	○	☉	○	☉	○	☉	○
	Chewability	☉	x	x	☉	○	☉	☉	☉	☉	☉	○	☉
	Brittleness	☉	☉	○	x	○	○	○	○	○	○	○	☉
	Surface Roughness	☉	x	☉	○	☉	○	☉	○	○	○	☉	○
	Flavor Evaluation	☉	x	x	x	○	○	○	☉	☉	☉	○	☉
	Flavor Evaluation [points]	10	2	1	3	5	6	7	9	10	8	6	9

[0046]

[Discussion]

Table 1 shows the proportions of the ingredients and the results of the physical property evaluation and sensory evaluation for Example products 1 to 8 and Comparative Example products 1 to 3.

(1) Cheese-like foods in which the mass ratio of the total mass of starch and plant-based protein to water was not between 0.40 and 0.80, inclusive, or the mass ratio of plant-based protein to fats and oils was not between 0.10 and 0.50, inclusive, did not meet the evaluation criteria for at least one of the physical property evaluation items, hardness, chewability, brittleness, and surface roughness (Comparative Examples 1 to 3). Furthermore, these cheese-like foods exhibited poor texture such as oil-off and syneresis, and in sensory evaluation, their textures were significantly different from those of processed cheese, and it was found that they were not acceptable for the texture of processed cheese (Comparative Examples 1 to 3).

(2) On the other hand, cheese-like food having a mass ratio of the total mass of starch and plant-based protein to water of 0.40 to 0.80, inclusive, and a mass ratio of plant-based protein to fats and oils of 0.10 to 0.50, inclusive, met the evaluation criteria for all physical property evaluation items, hardness, chewability, brittleness, and surface roughness, and it was found that the cheese-like food has acceptable flavor and texture (Example 1). Furthermore, it was found that the cheese-like food was further improved for the texture by comprising tapioca hydroxypropyl distarch phosphate as starch and the texture was closer to that of commercially available processed cheese (Examples 2 to 8). In particular, Example products 4 to 6 had a pleasant texture substantially equivalent to that of commercially available processed cheese (Examples 4 to 6).

(3) While cheese-like foods tend to have a crumbly and mealy texture as the plant-based protein content increases, Example product 6, which contained 10% pea-derived protein, had a pleasant texture substantially equivalent to that of commercially available

processed cheese.

[0047]

[Table 2]

		Processed Cheese	Example 9	Example 10	Example 11	Example 12
Fats and oils	rapeseed oil (%)	-	23.0	23.0	23.0	23.0
Starch	potato oxidized starch (%)	-	10.0	10.0	10.0	10.0
Emulsifier	potato starch sodium octenyl succinate (%)	-	2.0	2.0	2.0	2.0
Emulsifier	waxy starch sodium octenyl succinate (%)	-	1.5	1.5	1.5	1.5
Starch	tapioca hydroxypropyl distarch phosphate (%)	-	-	-	-	6.6
Starch	tapioca hydroxypropylated starch (%)	-	-	-	-	4.0
Starch	waxy hydroxypropyl distarch phosphate (%)	-	12.0	-	-	-
Starch	corn hydroxypropyl distarch phosphate (%)	-	-	12.0	-	-
Starch	tapioca acetylated distarch adipate (%)	-	-	-	12.0	-
Plant-based protein	pea-derived protein (%)	-	3	3	3	3
	seasonings (salt, flavorings) (%)	-	1.0	1.0	1.0	1.0
	water (%)	-	47.5	47.5	47.5	48.9
	total (%)	-	100.0	100.0	100.0	100.0
	mass ratio of the total mass of starch and protein to water	-	0.53	0.53	0.53	0.48
	mass ratio of plant-based protein to fats and oils	-	0.13	0.13	0.13	0.13
	mass ratio of total mass of hydroxypropylated starch, hydroxypropyl distarch phosphate, and acetylated distarch adipate to starch	-	0.55	0.55	0.55	0.51
	Hardness	◎	◎	◎	◎	○
	Chewability	◎	◎	◎	◎	○
	Brittleness	◎	○	○	◎	○
	Surface Roughness	◎	○	○	◎	○
	Flavor Evaluation	◎	◎	◎	◎	○
	Flavor Evaluation [points]	10	8	8	8	5

[0048]

Table 2 shows the proportions of the ingredients and the results of the physical property evaluation and sensory evaluation for Example products 9 to 12.

(1) Even when all of the tapioca hydroxypropyl distarch phosphate in Example 8 was replaced with waxy hydroxypropyl distarch phosphate, corn hydroxypropyl distarch phosphate, or tapioca acetylated distarch adipate, the cheese-like foods still met the evaluation criteria for physical property evaluation items, hardness, chewability, brittleness, and surface roughness. Furthermore, the sensory evaluations resulted in a favorable

texture substantially equivalent to that of commercially available processed cheese (Examples 9 to 11).

(2) When part of the tapioca hydroxypropyl distarch phosphate in Example 8 was replaced with tapioca hydroxypropylated starch, the cheese like food had a texture different from that of commercially available processed cheese, but was acceptable without any problems in the flavor and texture (Example 12).

[0049]

[Example 13]

Individually packaged portion-type cheese-like foods are produced as follows.

Plant-based protein, starch, fats and oils, emulsifier, water, and seasonings are prepared, and each ingredient is weighed and charged into the emulsification apparatus. The mixture is then heated and stirred in the same manner as in Examples 1 to 12 to obtain an emulsified mixture. The emulsified mixture is then filled into aluminum foil portion containers, packaged, and cooled at 5 °C for at least 24 hours to produce individually packaged portion-type cheese-like foods.

CLAIMS

[Claim 1]

A cheese-like food comprising starch, water, an emulsifier, fats and oils, and a plant-based protein, wherein

the mass ratio of the total mass of the starch and the plant-based protein to the water is 0.40 or more and 0.80 or less, and

the mass ratio of the plant-based protein to the fats and oils is 0.10 or more and 0.55 or less.

[Claim 2]

The cheese-like food of claim 1, wherein

the starch comprises at least one of hydroxypropylated starch, hydroxypropyl distarch phosphate, and acetylated distarch adipate, and the mass ratio of the total mass thereof to the starch is 0.10 or more and 0.60 or less.

[Claim 3]

The cheese-like food of claim 1 or 2, wherein

the cheese-like food comprises at least 3 mass% of the plant-based protein.

[Claim 4]

The cheese-like food of claim 1 or 2, wherein

the emulsifier comprises starch sodium octenyl succinate.

[Claim 5]

The cheese-like food of claim 1 or 2, wherein

the plant-based protein is a pea-derived protein.

[Claim 6]

The cheese-like food of claim 1 or 2, wherein
the cheese-like food is an individually packaged portion-type food.

[Claim 7]

A method for producing a cheese-like food, comprising:
preparing a mixture comprising starch, water, an emulsifier, fats and oils, and
plant-based protein; and
stirring the mixture while heating, wherein
the mass ratio of the total mass of the starch and the plant-based protein to the
water is 0.40 or more and 0.80 or less, and
the mass ratio of the plant-based protein to the fats and oil is 0.10 or more and
0.55 or less.

[Claim 8]

The method for producing a cheese-like food of claim 7, wherein
the starch comprises at least one of hydroxypropylated starch, hydroxypropyl
distarch phosphate, and acetylated distarch adipate, and the mass ratio of the total mass
thereof to the starch is 0.10 or more and 0.60 or less.

[Claim 9]

The method for producing a cheese-like food of claim 7 or 8, wherein
the cheese-like food comprises at least 3 mass% of the plant-based protein.

[Claim 10]

The method for producing a cheese-like food of claim 7 or 8, wherein
the emulsifier comprises starch sodium octenyl succinate.

[Claim 11]

The method for producing a cheese-like food of claim 7 or 8, wherein the plant-based protein is a pea-derived protein.