

SPECIFICATION

TITLE OF INVENTION: ACETYLATED PEA STARCH

5 TECHNICAL FIELD

[0001]

The present invention relates to acetylated pea starch.

BACKGROUND ART

10 [0002]

In fried (or fried-like) food, materials using starch have been used to improve texture of coating and tenderness and moistness of ingredients.

[0003]

15 Examples of materials made using starch include the examples in Patent Documents 1 to 3.

[0004]

Patent Document 1 describes a composition for a non-fried food coating, the composition including 20 to 80% by mass of
20 wheat flour, 2 to 20% by mass of a powdered sugar composition, corn grits, egg white powder, and 3 to 20% by mass of glutinous rice starch and/or tapioca starch, in which the sugar composition includes 70 to 100% by mass of oligosaccharides of bioses to hexoses and indicates that the use of the coating
25 composition makes it possible to obtain non-fried food for which the coating has a presence, the coating texture is good, and the ingredients are juicy.

[0005]

Patent Document 2 describes a coating material for fried food that contains a flaky starch mass, wherein the starch mass includes a pregelatinized starch, the thickness of the flaky starch mass is 100 μm to 1000 μm , and the content of the liquid component in the flaky starch mass is less than 20% and indicates that the use of the coating material for fried food obtains fried food having a favorable appearance and a crispy, non-greasy, light-textured coating.

10 [0006]

Patent Document 3 describes a method for producing Karaage, which includes a first step of sprinkling a powdery granular composition at least containing at least one particular starch selected from the group consisting of corn starch, wheat starch, potato starch, tapioca starch, Mung Bean starch, pea starch, rice starch, and processed starches thereof on an ingredient, and a second step of allowing the ingredient sprinkled with the powdery granular composition to stand for 30 minutes or more, the method for producing Karaage obtaining Karaage food having an improved coating hardness.

RELATED DOCUMENT

PATENT DOCUMENT

[0007]

25 Patent Document 1 Japanese Unexamined Patent Publication,
First Publication No. 2018-014915

Patent Document 2 PCT International Publication No.

W02020/110307

Patent Document 3 Japanese Unexamined Patent Publication,
First Publication No. 2021-141819

5 SUMMARY OF THE INVENTION

TECHNICAL PROBLEM

[0008]

In Patent Documents 1 to 3 described above, when storing
the produced fried (or fried-like) food, there were problems in
10 terms of maintaining the texture of the fried (or fried-like)
food after storage.

In the light of the above circumstances, it is desirable to
develop materials with which it is possible to maintain the
texture of fried (or fried-like) food after storage when
15 producing and storing the fried (or fried-like) food.

SOLUTION TO PROBLEM

[0009]

The present inventors found that, by setting the acetyl
group content in acetylated pea starch to a specific range, it
20 is possible to obtain acetylated pea starch with which it is
possible to maintain the texture of fried (or fried-like) food
using the acetylated pea starch as a coating material, after
storage.

[0010]

25 The present invention provides the following acetylated pea
starch, coating material, fried (or fried-like) food, method for
maintaining a texture of a fried (or fried-like) food after

storage, and method for producing acetylated pea starch.

[0011]

[1] Acetylated pea starch including an acetyl group with a content of more than 1.6% by mass.

5 [2] The acetylated pea starch according to [1], in which, when a slurry having a dry matter-converted mass concentration of the acetylated pea starch of 8% by mass is heated to 95°C, a temperature at which a viscosity starts to increase, as measured by a Rapid Visco Analyzer (RVA), is 60.0°C or higher and 68.0°C
10 or lower.

[3] The acetylated pea starch according to [1] or [2], which is for use in food.

[4] The acetylated pea starch according to any of [1] to [3], which is for use in a coating material.

15 [5] The acetylated pea starch according to any of [1] to [4], in which a content of an under-sieve fraction through a sieve with an opening of 0.3 mm is equal to or more than 50% by mass and equal to or less than 100% by mass with respect to an entirety of the acetylated pea starch.

20 [6] A coating material including the acetylated pea starch according to any of [1] to [5].

[7] The coating material according to [6], in which the coating material is one selected from the group consisting of batter and predust.

25 [8] A fried (or fried-like) food including the coating material according to [6] or [7].

[9] The fried (or fried-like) food according to [8], in

which the fried (or fried-like) food is one selected from the group consisting of Karaage, deep-fried bread, Tatsuta-age, fried chicken, chicken nuggets, pork cutlets, minced meat cutlets, chicken cutlets, cream croquettes, potato croquettes, 5 pumpkin croquettes, fried fish, fried shrimp, fried oysters, fried squid, doughnuts, and tempura.

[10] A method for maintaining a texture of a fried (or fried-like) food, the method including

attaching the coating material according to [6] or [7] to 10 an outer side of an ingredient,

heat cooking the ingredient to which the coating material is attached to obtain a fried (or fried-like) food, and

storing the fried (or fried-like) food at a temperature of 20°C or higher and 85°C or lower.

15 [11] A method for producing the acetylated pea starch according to any of [1] to [5], the method including

preparing a slurry of pea starch, and

adding a vinyl acetate monomer or acetic anhydride to the slurry for esterification,

20 in which, in the adding a vinyl acetate monomer or acetic anhydride for esterification, an added amount of the vinyl acetate monomer or the acetic anhydride is equal to or more than 4 parts by mass and equal to or less than 7 parts by mass with respect to 100 parts by mass of a dry matter-converted mass of 25 the pea starch.

ADVANTAGEOUS EFFECTS OF INVENTION

[0012]

According to the present invention, it is possible to provide a novel material suitable for use as a coating material.

5 DESCRIPTION OF EMBODIMENTS

[0013]

A description will be given below of embodiments of the present invention while providing specific examples of each component. In the present specification, unless otherwise
10 specified, "A to B" indicating a numerical range means equal to or more than A and equal to or less than B.

In addition, in the present specification, fried food and food like fried food are collectively referred to as "fried (or fried-like) food".

15 [0014]

1. Acetylated Pea Starch

The acetylated pea starch according to the present embodiment has an acetyl group content of more than 1.6% by mass.

20 Acetylated starch is starch in which hydrogen atoms such as hydroxyl groups in glucose in starch are replaced with acetyl groups, resulting in esterification.

The acetyl group content represents the content (% by mass) of acetyl groups ($\text{CH}_3\text{CO}-$) in starch converted to dry matter.

25 It is possible to measure the acetyl group content in accordance with Japan's Specifications and Standards for Food Additives (Ministry of Health, Labor and Welfare, Consumer

Affairs Agency) 9th Edition (2018), component specifications and storage standards, "Acetylated distarch adipate", and "Purity test (2) acetyl groups 2.5% or less."

[0015]

5 From the viewpoint of maintaining the texture of the coating and the tenderness and moistness of an ingredient (core ingredient) of fried (or fried-like) food even after storage, the acetyl group content of the acetylated pea starch is more than 1.6% by mass, preferably 1.65% by mass or more, more
10 preferably 1.7% by mass or more, even more preferably 1.75% by mass or more, yet more preferably 1.8% by mass or more, still more preferably 1.9% by mass or more, and especially preferably 2.0% by mass or more and preferably 2.5% by mass or less, more preferably 2.4% by mass or less, and even more preferably 2.3%
15 by mass or less.

 In addition, the upper limit of the acetyl group content of the acetylated pea starch is preferably not more than the range specified in Japan's Specifications and Standards for Food Additives (Ministry of Health, Labor and Welfare, Consumer
20 Affairs Agency), 9th Edition (2018), and more preferably 2.5% by mass or less.

[0016]

 It is possible to suitably use the acetylated pea starch obtainable in the present embodiment in food and, more
25 specifically, suitable use is possible as a coating material for fried (or fried-like) food. By using the acetylated pea starch in the present embodiment as a coating material, it is possible

to obtain fried (or fried-like) food having good coating and ingredient textures and, even when the obtained fried (or fried-like) food is stored at a temperature of preferably 20°C to 85°C, deterioration during storage is decreased and it is possible to maintain good textures even after storage.

In addition, in the present invention, the "texture" specifically refers to the crispness of the coating and chewiness of the coating of fried (or fried-like) food, the tenderness and moistness of the ingredient, and the like. In addition, the chewiness of the coating refers to how difficult it is to take a bite of the food when chewing and to improve the chewiness of the coating refers to reducing hardness of chewing and making it easier to take a bite.

[0017]

The details of the mechanism by which the above-described effects are obtained are not clear, and may be explained as follows.

Pea starch, which is the raw material for acetylated pea starch, has the property of being less prone to absorbing water and swelling than starches derived from other raw materials (for example, rice starch and tapioca starch). Therefore, when used in fried (or fried-like) food or the like, it is possible to obtain effects such as improving the texture of the coating.

[0018]

On the other hand, pea starch easily retrogrades and has a disadvantage in that, when food made using native pea starch is stored, the texture becomes coarse during storage.

However, it is considered that acetylating such pea starch makes it possible to suppress the deterioration of the texture due to retrogradation while maintaining the original effect of the pea starch of improving the texture.

5 [0019]

The peas that are the raw material for acetylated pea starch belong to the genus *Pisum*. Among these peas, yellow peas are preferable from the viewpoints of maintaining the texture of fried (or fried-like) food after storage and being easy to
10 obtain.

Pea starch is mainly produced as a by-product after extracting protein from peas.

The method for producing pea starch from peas is not limited and it is possible to use any known method as
15 appropriate. It is also possible to use commercially available pea starch.

In addition, the pea starch is preferably native pea starch from the viewpoint of maintaining the texture of the fried (or fried-like) food after storage.

20 [0020]

From the viewpoint of improving the texture of the fried (or fried-like) food after storage, the amylose content of the pea starch which is the raw material for the acetylated pea starch is preferably 30% by mass or more, more preferably 40% by
25 mass or more, and, from the viewpoint of further decreasing the retrogradation of the pea starch, preferably 50% by mass or less and more preferably 45% by mass or less.

[0021]

An explanation will be given below of the properties of acetylated pea starch.

[0022]

5 From the viewpoint of maintaining the preferable texture of the coating of the fried (or fried-like) food even after storage, when a slurry of acetylated pea starch having a dry matter-converted mass concentration of 8% by mass is maintained at 40°C for 1 minute and then heated to 95°C at a rate of
10 6°C/min using a Rapid Visco Analyzer (RVA), the lower limit of the temperature at which the viscosity starts to increase is preferably 60.0°C or higher, more preferably 62.0°C or higher, even more preferably 64.0°C or higher, and yet more preferably 65.0°C or higher. In addition, from the same viewpoint, the
15 upper limit of the temperature at which the viscosity starts to increase is preferably 68.0°C or lower, more preferably 67.5°C or lower, even more preferably 67.0°C or lower, and yet more preferably 66.5°C or lower.

[0023]

20 From the viewpoint of maintaining the preferable texture of the coating of the fried (or fried-like) food even after storage, the maximum viscosity during the heating to 95°C is preferably 2000 cP or more, more preferably 2100 cP or more, even more preferably 2150 cP or more, and yet more preferably
25 2200 cP or more and, from the same viewpoint, 3000 cP or less, more preferably 2900 cP or less, even more preferably 2800 cP or less, yet more preferably 2700 cP or less, and still more

preferably 2600 cP or less.

In addition, from the viewpoint of maintaining the preferable texture of the coating of the fried (or fried-like) food even after storage, the upper limit of the maximum

5 viscosity during heating to 95°C is preferably 3500 cP or less, more preferably 3300 cP or less, even more preferably 3100 cP or less, yet more preferably 2900 cP or less, and still more preferably 2700 cP or less.

[0024]

10 In addition, from the viewpoint of maintaining a preferable texture of the coating of the fried (or fried-like) food even after storage, the minimum viscosity of the acetylated pea starch slurry during heating to 95°C, maintaining at 95°C for 5 minutes, and cooling to 25°C at a rate of 4.5°C/min is

15 preferably 1280 cP or more, more preferably 1300 cP or more, even more preferably 1320 cP or more, and yet more preferably 1350 cP or more and, from the same viewpoint, 1800 cP or less, more preferably 1700 cP or less, even more preferably 1600 cP or less, yet more preferably 1500 cP or less, and still more
20 preferably 1400 cP or less.

In addition, from the same viewpoint, the lower limit of the minimum viscosity of the acetylated pea starch slurry during heating to 95°C, maintaining at 95°C for 5 minutes, and cooling to 25°C at 4.5°C/min is preferably 1270 cP or more from the

25 viewpoint of maintaining a preferable texture of the coating of the fried (or fried-like) food even after storage, more preferably 1280 cP or more, even more preferably 1290 cP or

more, yet more preferably 1300 cP or more, still more preferably 1320 cP or more, and especially preferably 1350 cP or more.

[0025]

Here, the method for measuring the temperature at which the
5 viscosity starts to increase and the maximum viscosity during
the heating to 95°C, and the viscosity when cooled to 25°C is as
follows.

(i) Acetylated pea starch and water are mixed in a
dedicated aluminum container to prepare a slurry having a dry
10 matter-converted mass concentration of acetylated pea starch of
8% by mass.

A dedicated paddle is placed into the aluminum container,
which is set in a Rapid Visco Analyzer (RVA).

(ii) While measuring the viscosity under stirring at 160
15 rpm, the temperature is maintained at 40°C for 1 minute, then
heated from 40°C to 95°C at a rate of 6°C/min.

The temperature at which the viscosity starts to increase
while heating at a rate of 6°C/min is the gelatinization onset
temperature (°C).

20 (iii) The temperature is maintained at 95°C for 5 minutes,
then cooled to 25°C at 4.5°C/min.

(iv) The maximum viscosity (cP) during the heating process
from 25°C to 95°C and the minimum viscosity (cP) during the
cooling process to 25°C after reaching 95°C are read out.

25 [0026]

An explanation will be given of the particle size of the
acetylated pea starch.

From the viewpoint of improving handling properties of the acetylated pea starch and maintaining the texture of fried (or fried-like) food after storage, the content of the under-sieve fraction (particles) through a sieve with an opening of 0.3 mm in the acetylated pea starch is preferably 50% by mass or more with respect to the entire acetylated pea starch, more preferably 60% by mass or more, and even more preferably 70% by mass or more. In addition, from the same viewpoint, the content of the under-sieve fraction through a sieve with an opening of 0.3 mm in the acetylated pea starch is preferably 100% by mass or less with respect to the entire acetylated pea starch, and more preferably 99% by mass or less.

[0027]

(Uses)

The acetylated pea starch of the present embodiment is preferably for use in food. In the food, use as a coating material for fried (or fried-like) food is more preferable.

The coating material is preferably one selected from the group consisting of batter and predust.

By using the acetylated pea starch of the present embodiment as a coating material for fried (or fried-like) food, it is possible to maintain the texture of the fried (or fried-like) food when the fried (or fried-like) food is stored after being produced.

A description will be given below of the specific contents of the fried (or fried-like) food.

[0028]

2. Method for Producing Acetylated Pea Starch

The method for producing acetylated pea starch of the present embodiment includes preparing a slurry of the pea starch and adding a vinyl acetate monomer or acetic anhydride to the
5 slurry for esterification, that is, to acetylate the pea starch.
[0029]

In the preparing the slurry of the pea starch, the slurry specifically includes pea starch as a raw material and water.

From the viewpoint of performing efficient and reliable
10 acetylation, the dry matter-converted mass concentration of the pea starch in the slurry is, for example, 20% by mass or more with respect to the entire slurry, preferably 25% by mass or more, and more preferably 30% by mass or more. In addition, from the viewpoint of improving the stability of the acetylation
15 reaction, the dry matter-converted mass concentration of the pea starch in the slurry is, for example, 50% by mass or less with respect to the entire slurry, more preferably 45% by mass or less, even more preferably 40% by mass or less, and yet more preferably 35% by mass or less.

20 Here, it is possible to determine the dry matter-converted mass concentration of the pea starch in the slurry by dividing the mass of dry matter, which is obtained by subtracting, from the starch mass, the moisture mass calculated from the moisture concentration (% by mass) in the starch, by the total mass
25 obtained by adding the starch mass and the mass of water added when preparing the slurry, and then multiplying the result by 100.

[0030]

In the acetylating the pea starch, it is possible to use a vinyl acetate monomer or acetic anhydride as the acetylating agent used for the acetylation. It is possible to use the vinyl acetate monomer or the acetic anhydride regardless of the type, 5 purity, or the like.

In the acetylating the pea starch, from the viewpoint of keeping the acetyl group content of the acetylated pea starch within an appropriate range and of obtaining sufficient 10 acetylation, the added amount of vinyl acetate monomer or acetic anhydride is preferably 4 parts by mass or more with respect to 100 parts by mass of the dry matter-converted mass of the pea starch, more preferably 4.2 parts by mass or more, even more preferably 4.5 parts by mass or more, and yet more preferably 15 4.8 parts by mass or more and, in terms of reducing excessive acetylation of the pea starch, preferably 7 parts by mass or less, more preferably 6.8 parts by mass or less, even more preferably 6.7 parts by mass or less, and yet more preferably 6.6 parts by mass or less.

20 [0031]

In the acetylating the pea starch, from the viewpoint of performing sufficient and reliable acetylation, the pH of the slurry of the pea starch during the acetylation reaction is preferably 8.5 or more, more preferably 8.6 or more, even more 25 preferably 8.7 or more, and yet more preferably 8.8 or more and, from the viewpoint of reducing excessive acetylation of the pea starch and gelatinization of the slurry, preferably 9.3 or less,

more preferably 9.2 or less, even more preferably 9.1 or less, and yet more preferably 9.0 or less.

[0032]

In addition, in the acetylating the pea starch, the pH is
5 preferably maintained under the above-described conditions by adding a base to the slurry. In this case, the addition of the base to the slurry may be performed continuously or intermittently.

Specific examples of bases include metal hydroxides such as
10 sodium hydroxide, potassium hydroxide, calcium hydroxide, magnesium hydroxide, and the like. From the viewpoint of stably maintaining the pH under the above-described conditions, the base is preferably an alkali metal hydroxide, more preferably sodium hydroxide, and even more preferably an aqueous sodium
15 hydroxide solution having a concentration of equal to or more than 1% by mass and equal to or less than 5% by mass.

Here, maintaining the pH of the slurry means keeping the slurry pH during the acetylation reaction within a range of ± 0.2 of the set value.

20 [0033]

In the acetylating the pea starch, from the viewpoint of increasing the efficiency of the acetylation reaction, the temperature of the slurry is preferably 10°C or higher, more preferably 15°C or higher, and even more preferably 20°C or
25 higher and, from the viewpoint of increasing the production stability of the acetylated pea starch, preferably 60°C or lower, more preferably 50°C or lower, and even more preferably

45°C or lower.

[0034]

In addition, it is possible to set the predetermined time in the acetylating the pea starch to be the time until the
5 above-described acetylation reaction is finished, and from the viewpoint of increasing the yield of the acetylated pea starch, the predetermined time is preferably 30 minutes or more, more preferably 40 minutes or more, and even more preferably 50 minutes or more. In addition, from the viewpoint of increasing
10 the production efficiency of the acetylated pea starch, the predetermined time is preferably 120 minutes or less, more preferably 100 minutes or less, and even more preferably 80 minutes or less.

[0035]

15 In addition, the method for producing acetylated pea starch may further include, after the acetylating the pea starch, stopping the acetylation reaction by adding an acid to the slurry to adjust the pH to 7.0 or less. From the viewpoint of reliably stopping the acetylation reaction, the pH of the slurry
20 is preferably adjusted to 7.0 or less and more preferably adjusted to 6.5 or less. In addition, from the viewpoint of decreasing decomposition of the acetylated pea starch, the lower limit of the pH of the slurry in the stopping the acetylation reaction is preferably 3.5 or more, more preferably 4.5 or more,
25 and even more preferably 5.5 or more.

Specific examples of the acid to be used include inorganic acids such as hydrochloric acid, nitric acid, and sulfuric acid;

and organic acids such as acetic acid. From the viewpoint of reliably stopping an oxidation reaction, the acid is preferably an inorganic acid, more preferably hydrochloric acid, and even more preferably hydrochloric acid having a concentration of
5 equal to or more than 1% by mass and equal to or less than 5% by mass.

[0036]

After the stopping the acetylation reaction, one or two or more steps selected from the group consisting of washing the
10 acetylated pea starch in the slurry with water, dehydrating the acetylated pea starch, filtering the acetylated pea starch, drying the acetylated pea starch, pulverizing the acetylated pea starch, and sieving the acetylated pea starch may be further performed.

15 Among the above, in the drying the acetylated pea starch, for example, the filtered acetylated pea starch may be dried at a temperature of 20°C or higher and 150°C or lower.

The above-described sieving the acetylated pea starch is preferably carried out after the drying the acetylated pea
20 starch. In the sieving the acetylated pea starch, it is preferable to use a sieve with an opening of 0.3 mm conforming to the JIS-Z8801-1 standard and to recover the under-sieve fraction for the opening of 0.3 mm.

[0037]

25 3. Coating Material

In the present embodiment, the coating material includes the acetylated pea starch in the present embodiment described

above.

In the present embodiment, the coating material may be used as is, or may be used in combination with other additional components.

5 In addition, the coating material may be in the form of a liquid or a powder.

The coating material is preferably one selected from the group consisting of batter and predust.

[0038]

10 (Batter)

In the present embodiment, the batter includes the acetylated pea starch in the present embodiment described above.

In addition, the batter further includes water. The content of water in the batter may be the remainder after excluding the
15 content of components other than water included in the batter.

When preparing the batter, the acetylated pea starch may be dispersed alone in water to prepare a liquid batter, or other components may also be added to prepare a liquid batter.

[0039]

20 From the viewpoint of maintaining the texture of the fried (or fried-like) food after storage and improving handling properties of the batter, the content of the acetylated pea starch in the entire batter is preferably 5% by mass or more, more preferably 6% by mass or more, even more preferably 7% by
25 mass or more, and yet more preferably 8% by mass or more. In addition, from the same viewpoint, the content of acetylated pea starch in the entire batter is preferably 30% by mass or less,

more preferably 25% by mass or less, even more preferably 20% by mass or less, and yet more preferably 15% by mass or less.

Here, the entire batter refers to the total amount of batter including water.

5 [0040]

In addition, when acetylated pea starch is used in the batter, it is preferable to further include a thickening stabilizer such as xanthan gum, locust bean gum, or guar gum. Due to this, it is possible to reduce precipitation of the acetylated pea starch and more stably carry out the dispersion in the batter.

When a thickening stabilizer is used in the batter, from the viewpoint of improving the dispersibility of the acetylated pea starch, the content of the thickening stabilizer is preferably more than 0 parts by mass with respect to 100 parts by mass of the acetylated pea starch in the batter, more preferably 0.1 parts by mass or more, even more preferably 0.3 parts by mass or more, yet more preferably 0.8 parts by mass or more, and still more preferably 1.2 parts by mass or more and, from the same viewpoint, preferably 3 parts by mass or less, more preferably 2.5 parts by mass or less, and even more preferably 2.0 parts by mass or less.

[0041]

(Predust)

25 In the present embodiment, the predust includes the acetylated pea starch in the present embodiment described above.

From the viewpoint of maintaining the texture of the fried

(or fried-like) food after storage and improving handling properties of the predust, the content of acetylated pea starch in the entire predust is preferably 50% by mass or more, more preferably 60% by mass or more, even more preferably 70% by mass or more, and yet more preferably 80% by mass or more. The upper limit of the content of acetylated pea starch in the entire predust is not limited, and from the same viewpoint, is, for example, 100% by mass or less and preferably 100% by mass.

[0042]

10 (Other Components)

In addition, the coating material may further include components other than acetylated pea starch. Examples of the other components include starches other than acetylated pea starch, such as native starch (raw starch) and processed starch; cereal flours such as wheat flour and rice flour; dried eggs such as whole egg powder; leavening agents such as baking powder; coating materials other than the above-described coating materials, such as bread crumbs; proteins such as gluten; powdered seasonings; colorants; emulsifiers, and the like.

20 [0043]

4. Fried (or fried-like) Food

The fried (or fried-like) food in the present embodiment includes the coating material in the present embodiment described above.

25 In the fried (or fried-like) food, the coating material may coat a part of the ingredient or may coat the entire ingredient. In addition, the coating material may also be attached to a part

of the ingredient or may be attached to the entire ingredient.

In addition, it is possible for the fried (or fried-like) food of the present embodiment to use at least one of the batter and predust described above as the coating material, or to use
5 both batter and predust.

[0044]

In addition, the ingredients of the fried (or fried-like) food in the present embodiment are not limited and it is possible to use ingredients that are typically used for fried
10 (or fried-like) food and examples thereof include meats such as chicken, pork, and beef, processed meat products, and processed meat-like products; seafood such as shrimp, squid, oysters, scallops, horse mackerel, and cod; processed marine products such as fish paste products; vegetables such as potatoes,
15 onions, pumpkins, green peppers, and shiitake mushrooms, and processed products made therefrom; eggs such as chicken eggs and quail eggs, and processed products made therefrom; grains such as rice and corn, and processed products made therefrom; beans such as soybeans, and processed products made therefrom; dairy
20 products such as cheese; doughs such as bread dough and doughnut dough; sauces such as the white sauce in cream croquettes and the curry in curry bread; mashed vegetables in potato croquettes and pumpkin croquettes; and cheeses. In addition, it is also possible for the ingredients of the fried (or fried-like) food
25 in the present embodiment to include, at the same time, solid ingredients such as meats, seafood, vegetables, fruits, and pasta cut into small pieces, and solid ingredients that are

originally in small pieces, such as corn and green peas.

[0045]

The fried (or fried-like) food is preferably one selected from the group consisting of Karaage, deep-fried bread, Tatsuta-
5 age, fried chicken, chicken nuggets, pork cutlets, minced meat cutlets, chicken cutlets, cream croquettes, potato croquettes, pumpkin croquettes, fried fish, fried shrimp, fried oysters, fried squid, doughnuts, and tempura.

[0046]

10 The method for producing the fried (or fried-like) food is not limited and, for example, the method for producing the fried (or fried-like) food may include obtaining the acetylated pea starch in the present embodiment;
preparing a coating material including the acetylated pea
15 starch;
attaching the coating material to the outer side of the ingredient;
obtaining a fried (or fried-like) food by heat cooking the ingredient to which the coating material is attached; and
20 storing the fried (or fried-like) food at a temperature of 20°C or higher and 85°C or lower.

[0047]

In addition, when the attaching the coating material to the outer side of the ingredient includes both attaching batter to
25 the outer side of the ingredient and attaching predest to the outer side of the ingredient, the steps may be in any order. In addition, the attaching the batter may be performed a plurality

of times, such as in a first battering step and a second battering step.

[0048]

Specific examples of cooking with heat include deep frying
5 in edible oil and heating on an oiled frying pan or iron plate.
In addition, the heat cooking may also be performed by dry heat
cooking in an oven or the like, microwave cooking (cooking in
microwave oven), steam cooking or superheated steam cooking, and
the like. For example, from the viewpoint of improving the
10 crispness during storage of the fried (or fried-like) food and
the moistness of the ingredient, the deep frying temperature
when deep frying in edible oil is preferably 160°C or higher and
more preferably 165°C or higher and, from the same viewpoint,
preferably 190°C or lower and more preferably 185°C or lower.

15 [0049]

In addition, the fried (or fried-like) food may be obtained
by coating the ingredient with a coating material, then carrying
out a heat treatment step such as pre-deep-frying, a storage
step such as freezing and storing, and a reheating step such as
20 re-deep-frying.

[0050]

In the present embodiment, the fried (or fried-like) food
may be food similar to fried food (non-fried food) that has a
taste and texture similar to fried food and that is produced by
25 baking or steaming using a small amount of oil, without going
through frying (deep frying) in oil.

In the food similar to fried food obtainable by these

methods, it is more preferable to coat the ingredients with a coating material including oil or to sprinkle oil on the coating material.

[0051]

5 After heat cooking, the obtained fried (or fried-like) food is stored at room temperature or at a temperature higher than room temperature. It is possible to set the storage temperature to, for example, 20°C or higher and 85°C or lower.

 When the storage temperature is 40°C or higher, the food
10 may be stored in a hot display case or the like.

[0052]

5. Method for Maintaining Texture of Fried (or fried-like) Food

 In the present embodiment, the method for maintaining the
15 texture of the fried (or fried-like) food includes attaching the coating material of the present embodiment to the outer side of an ingredient, heat cooking the ingredient to which the coating material is attached to obtain a fried (or fried-like) food, and storing the fried (or fried-like) food at a temperature of 20°C
20 or higher and 85°C or lower.

 The description of the coating material of the present embodiment is the same as in "3. Coating Material" above and thus will not be repeated.

[0053]

25 According to the method for maintaining the texture of the fried (or fried-like) food of the present embodiment, even when the fried (or fried-like) food is heat cooked and then stored at

a temperature of 20°C or higher and 85°C or lower, it is possible to decrease deterioration of the texture during storage and to maintain the texture of the fried (or fried-like) food after storage.

5 [0054]

Embodiments of the present invention are described above, and these embodiments are merely examples of the present invention and it is also possible to adopt various configurations other than the configurations described above.

10 In addition, the present invention is not limited to the embodiments described above and the present invention includes modifications, improvements, and the like within a range in which it is possible to achieve the object of the present invention.

15 Examples

[0055]

Examples of the present invention are shown below, and the scope of the present invention is not limited to these Examples.

In the following examples, the blending units are parts by
20 mass unless otherwise specified.

[0056]

The following raw materials were used for the acetylated pea starch.

- Pea starch: PEA STARCH SOJOM2201 (YANTAI SHUANGTA FOOD
25 CO., LTD. (importer: Sojitz Foods Corporation)) Amylose content:
42% by mass

- Tapioca starch: In-house product of J-Oil Mills, Inc.

- Vinyl acetate monomer: Produced by Fujifilm Wako Pure Chemical Industries, Ltd.

[0057]

(Production of Acetylated Starch)

5 (i) For each example, 269 parts by mass of water were added to 170 parts by mass of starch (containing 12% by mass of moisture) to prepare a slurry according to the blends listed in Table 1.

10 (ii) Three % by mass aqueous sodium hydroxide solution was added to the above-described slurry and the pH was adjusted to 8.9 using a pH meter, then, a vinyl acetate monomer was added in the blends in Table 1 and an acetylation reaction was performed for 1 hour while stirring. During the reaction, the pH of the reaction solution was maintained at 8.9 by adding 3% by mass
15 aqueous sodium hydroxide solution using a pH meter. In addition, during the reaction, the temperature of the slurry was maintained at 31°C.

20 (iii) After the reaction, the pH of the reaction solution was neutralized to 6.0 by adding 3% by mass aqueous hydrochloric acid solution.

25 (iv) After the reaction solution was washed with water, starch recovered by filtration was dried at 40 to 50°C and the under-sieve fraction that passed through a sieve with an opening of 0.3 mm conforming to the JIS-Z8801-1 standard was recovered to obtain the acetylated starch of each example.

The content (% by mass) of the under-sieve fraction for the opening of 0.3 mm in the acetylated starch is shown in Table 1.

[0058]

(Method for Measuring Acetyl Group Content)

The acetyl group content of each example of acetylated starch was measured according to the following measurement
5 method, in accordance with the method described in Japan's Specifications and Standards for Food Additives (Ministry of Health, Labor and Welfare, Consumer Affairs Agency), 9th Edition (2018), component specifications and storage standards, "Acetylated distarch adipate" and "Purity test (2) acetyl groups
10 2.5% or less". The acetyl group content of each example is shown in Table 1.

(i) The acetylated starch of each example was heated and dried at 130°C using a moisture meter (manufactured by Kensei Kogyo Co., Ltd., electromagnetic moisture meter: model number
15 MX50) to measure the moisture content and the anhydrous mass was calculated from the obtained moisture value.

(ii) 50 mL of water and a few drops of a 1.0 (w/v)% phenolphthalein ethanol solution were added to 5 g of acetylated starch based on anhydrous conversion and stirred until
20 homogenous.

(iii) A 0.1 N aqueous sodium hydroxide solution was added thereto until the liquid turned red and then 25 mL of a 0.45 N aqueous sodium hydroxide solution was added thereto and vigorously stirred at room temperature for 30 minutes.

25 (iv) Titration was performed using a 0.2 N hydrochloric acid until the red colored liquid disappeared and the amount of the 0.2 N hydrochloric acid used was recorded as titration value

A (mL).

(v) As a blank, 25 mL of a 0.45 N aqueous sodium hydroxide solution was similarly titrated with a 0.2 N hydrochloric acid until the red colored liquid disappeared and the amount of the
5 0.2 N hydrochloric acid used was recorded as titration value B (mL).

(vi) The acetyl group content (% by mass) was calculated using the following formula.

Formula: Acetyl group content (% by mass) = [(titration
10 value B - titration value A) × Normality of hydrochloric acid ×
0.043 × 100] ÷ acetylated starch anhydrate-converted mass (g)
[0059]

(Method for Measuring Viscosity using RVA)

(i) The starch of each example was mixed with water in a
15 dedicated aluminum container to prepare a slurry having a dry
matter-converted mass concentration of starch of 8 % by mass.

A dedicated paddle was placed into the aluminum container, which was set in a Rapid Visco Analyzer (RVA, manufactured by Terpene Corporation, model number: RVA-4800).

20 (ii) The mixture was maintained at 40°C for 1 minute while
measuring the viscosity under stirring at 160 rpm and then
heated from 40°C to 95°C at a rate of 6°C/min.

The temperature at which the viscosity started to increase during the heating at a rate of 6°C/min was the gelatinization
25 onset temperature (°C).

(iii) After maintaining the temperature at 95°C for 5 minutes, the temperature was cooled to 25°C at a rate of

4.5°C/min.

(iv) The maximum viscosity (cP) during the process of heating from 40°C to 95°C and the minimum viscosity (cP) during the cooling process to 25°C after reaching 95°C were read out.

5 The gelatinization onset temperature (°C), maximum viscosity (cP), and minimum viscosity (cP) are shown in Table 1.

[0060]

[Table 1]

Table 1

Acetylated starch blend (parts by mass)	Comparative Example 1	Example 1	Example 2	Example 3	Example 5	Comparative Example 2
Pea starch	170.00	170.00	170.00	170.00	170.00	
Tapioca starch						170.00
Water	269.00	269.00	269.00	269.00	269.00	269.00
Vinyl acetate monomer	4.55	8.55	9.77	7.15	9.35	8.55
Content of under-sieve fraction for opening of 0.3 mm (% by mass)	100	100	100	100	100	100
Acetyl group content (% by mass)	1.04	2.05	2.28	1.70	2.22	1.91
RVA maximum viscosity (cP)	2133	2459	2501	2180	3071	3216
RVA minimum viscosity (cP)	1266	1352	1352	1385	1296	1853
Gelatinization onset temperature (°C)	68.7	65.5	65.2	66.3	65.1	65.2

[0061]

5 Karaage and curry bread were made using the acetylated starch obtained in each example and evaluated. The materials used for the Karaage and curry bread are shown below.

- Bread flour: Camellia, produced by Nisshin Seifun Welna Inc.

10 • Cake flour: Super Violet, produced by Nisshin Seifun Welna Inc.

- Caster sugar: Caster sugar, produced by Mitsui Sugar Co., Ltd.

15 • Table salt: Table salt, produced by the Salt Business Center, Public Interest Foundation

- Sodium glutamate: Ajinomoto (registered trademark), produced by Ajinomoto Co., Inc.

- Soy sauce: Dark soy sauce, produced by Kikkoman Foods Co., Ltd.

5 • White pepper: White pepper, produced by Gaban Co., Ltd.

- Skimmed milk powder: Yotsuba Hokkaido skimmed milk powder, produced by Yotsuba Dairy Co., Ltd.

- Shortening: Facier, produced by J-Oil Mills, Inc.

10 • Batter flour: Chubo-oh Juicy Karaage Flour, produced by Daishow Co., Ltd.

- Semi-dry red: Instant Yeast Red, produced by Nichifutsu Shoji Co., Ltd.

- Xanthan gum: Echo Gum, produced by Sumitomo Pharma Food & Chemical Co., Ltd.

15 • Canola oil: Super Canola Oil, produced by J-Oil Mills, Inc.

- Fresh bread crumbs: Fresh bread crumbs, produced by Kyoei Food Co., Ltd.

[0062]

20 <Evaluation of Karaage>

(Preparation of Pickling Liquid)

The materials were mixed well according to the blends listed in Table 2 to prepare a pickling liquid.

(Preparation of Karaage)

25 (i) 100 parts by mass of chicken thigh meat cut to 23 to 27g per piece and 30 parts by mass of the pickling liquid prepared as described above were added to a tumbler (VACONA,

ESK-60) and tumbling was performed at 4°C for 90 minutes at a vacuum ratio of 80%.

(ii) 3 parts by mass of the acetylated starch of each example were added as predust to the tumbled chicken thigh meat and mixed by hand (no predust was used for Control Example 1).

(iii) A batter liquid (a mixture of 50% by mass of batter flour and 50% by mass of cold water) was attached to the outer side of the chicken thigh meat to which the predust was attached and the chicken thigh meat was pre-fried for 3 minutes in canola oil heated to 170°C.

(iv) The pre-fried chicken thigh meat was stored in a -50°C freezer for 16 hours and then stored in a -20°C freezer.

(v) The chicken thigh meat removed from the -20°C freezer was fried for 3 minutes in canola oil heated to 175°C to obtain Karaage.

(vi) The obtained Karaage was placed in a warming oven set at 65°C for 4 hours and then subjected to evaluation.

[0063]

[Table 2]

Table 2

Pickling liquid blend	(% by mass)
Caster sugar	2.00
Table salt	2.00
Sodium glutamate	0.70
Soy sauce	10.00
White pepper	0.08
Ice water	85.22
Total	100

20 [0064]

Three expert panelists evaluated the Karaage obtained as described above based on the following evaluation criteria. The evaluation score was decided by consensus and a score of 3 or more was a pass. The results are shown in Table 3.

5	(Evaluation Criteria)
	(Coating crispness)
	5: Very crisp
	4: Crisp
	3: Slightly crisp
10	2: Not very crisp
	1: Not crisp at all
	(Lack of coating chewiness)
	5: No chewiness at all
	4: Almost no chewiness
15	3: Little chewiness
	2: Slightly chewy
	1: Chewy
	(Meat tenderness)
	5: Very tender
20	4: Tender
	3: Slightly tender
	2: Slightly tough
	1: Tough
	(Moistness of meat)
25	5: Extremely juicy
	4: Very juicy
	3: Juicy

2: Slightly lacking in juiciness

1: Lacking in juiciness

[0065]

[Table 3]

Table 3

	Control Example 1	Comparative Example 1-1	Example 1-1	Example 2-1	Example 3-1	Example 5-1	Comparative Example 2-1
Predust used	-	Comparative Example 1	Example 1	Example 2	Example 3	Example 5	Comparative Example 2
Coating crispness (points)	1	2	4	5	3	5	2
Lack of coating chewiness (points)	1	2	4	5	3	5	1
Meat tenderness (points)	1	2	4	5	3	5	2
Moistness of meat (points)	1	2	4	5	3	5	2

[0066]

5 From Table 3, in Examples 1-1, 2-1, 3-1, and 5-1, in which acetylated pea starch having an acetyl group content of more than 1.6% by mass was used as the coating material, the texture of the Karaage after storage was better than that of Comparative Example 1-1, in which acetylated pea starch having an acetyl

10 group content of less than 1.6% by mass was used as the coating material. In addition, in Examples 1-1, 2-1, 3-1, and 5-1, the texture of the Karaage after storage was better than that of Comparative Example 2-1, in which acetylated starch made using tapioca starch as a raw material was used as the coating

15 material.

[0067]

<Evaluation of Curry Bread>

(Preparation of Batter Liquid)

Materials were mixed in the blends in Table 5 to prepare the batter liquid for each example.

(Production of Curry Bread)

(i) The bread dough materials in the blends in Table 4 were
5 placed in a mixer (Kanto Mixer HPI-20M, manufactured by Kanto
Mixing Machinery Co., Ltd.) and kneaded using a dough hook under
the conditions of a low speed for 2 minutes, a medium speed for
5 minutes, and a kneading temperature of 27°C.

(ii) The bread dough kneaded in (i) was subjected to a
10 first fermentation for 30 minutes under conditions of a
temperature of 27°C and a relative humidity of 80% RH.

(iii) The bread dough after the first fermentation was
divided into 50 g portions.

(iv) The bread dough in (iii) was left at 25°C for 15
15 minutes.

(v) The bread dough in (iv) was filled with 30 g of a curry
filling (Delica Filling RN Thick and Mild Onion Curry, produced
by Sonton Holdings Co., Ltd.)

(vi) After filling, the dough was battered using the batter
20 liquid obtained as described above adjusted to 20°C.

(vii) Fresh bread crumbs were attached to the battered
bread dough.

(viii) After the fresh bread crumbs were attached, the
bread dough was subjected to a second fermentation for 35
25 minutes under conditions of a temperature of 38°C and a relative
humidity of 50% RH.

(ix) After the second fermentation, the bread dough was

deep fried in canola oil heated to 180°C for 3 minutes and 30 seconds (2 minutes on one side, 1 minute and 30 seconds on the other side) to obtain curry bread.

(x) The obtained curry bread was stored at 25°C for 5 hours
5 and 30 minutes and then evaluated.

[0068]

[Table 4]

Table 4

Bread dough blend	(g)
Bread flour	850
Cake flour	150
Caster sugar	50
Table salt	18
Skimmed milk powder	30
Shortening	60
Whole egg	150
Semi-dry red	18
Water	450
Total	1776

[0069]

The curry bread obtained as described above was evaluated by six expert panelists based on the following evaluation criteria. The average value of the scores of the expert panelists was used as the evaluation score and a score of 3.5 or more was a pass. The results are shown in Table 5.

(Evaluation criteria)

10 (Surface crispness)

5: Very crisp

4: Crisp

3: Slightly crisp

2: Not very crisp

15 1: Not crisp at all

[0070]

[Table 5]

Table 5

Batter liquid blend (% by mass)	Control Example 2	Comparative Example 3	Example 4
Pea starch		10.00	
Acetylated pea starch of Example 1			10.00
Xanthan gum	0.15	0.15	0.15
Water	99.85	89.85	89.85
Total	100	100	100
Surface crispness (points)	1.0	3.2	5.0

[0071]

From Table 5, in Example 4, in which acetylated pea starch having an acetyl group content of more than 1.6% by mass was used as the coating material, the curry bread had a better texture after storage than that of Comparative Example 3, in which native pea starch was used as the coating material.

[0072]

This application claims priority based on Japanese Patent Application No. 2022-123107 filed August 2, 2022, the entire disclosure of which is incorporated herein by reference.

CLAIMS

[Claim 1]

Acetylated pea starch comprising an acetyl group with a
5 content of more than 1.6% by mass.

[Claim 2]

The acetylated pea starch according to claim 1,
wherein, when a slurry having a dry matter-converted mass
10 concentration of the acetylated pea starch of 8% by mass is
heated to 95°C, a temperature at which a viscosity starts to
increase, as measured by a Rapid Visco Analyzer (RVA), is 60.0°C
or higher and 68.0°C or lower.

15 [Claim 3]

The acetylated pea starch according to claim 1 or 2, which
is for use in food.

[Claim 4]

20 The acetylated pea starch according to claim 1 or 2, which
is for use in a coating material.

[Claim 5]

The acetylated pea starch according to claim 1 or 2,
25 wherein a content of an under-sieve fraction through a
sieve with an opening of 0.3 mm is equal to or more than 50% by
mass and equal to or less than 100% by mass with respect to an

entirety of the acetylated pea starch.

[Claim 6]

A coating material comprising the acetylated pea starch
5 according to claim 1 or 2.

[Claim 7]

The coating material according to claim 6,
wherein the coating material is one selected from the group
10 consisting of batter and predust.

[Claim 8]

A fried (or fried-like) food comprising the coating
material according to claim 6.
15

[Claim 9]

The fried (or fried-like) food according to claim 8,
wherein the fried (or fried-like) food is one selected from
the group consisting of Karaage, deep-fried bread, Tatsuta-age,
20 fried chicken, chicken nuggets, pork cutlets, minced meat
cutlets, chicken cutlets, cream croquettes, potato croquettes,
pumpkin croquettes, fried fish, fried shrimp, fried oysters,
fried squid, doughnuts, and tempura.

25 [Claim 10]

A method for maintaining a texture of a fried (or fried-
like) food, the method comprising:

attaching the coating material according to claim 6 to an outer side of an ingredient;

heat cooking the ingredient to which the coating material is attached to obtain a fried (or fried-like) food; and

5 storing the fried (or fried-like) food at a temperature of 20°C or higher and 85°C or lower.

[Claim 11]

A method for producing the acetylated pea starch according
10 to claim 1 or 2, the method comprising:

preparing slurry of pea starch; and

adding a vinyl acetate monomer or acetic anhydride to the slurry for esterification;

wherein, in the adding a vinyl acetate monomer or acetic
15 anhydride for esterification, an added amount of the vinyl acetate monomer or the acetic anhydride is equal to or more than 4 parts by mass and equal to or less than 7 parts by mass with respect to 100 parts by mass of a dry matter-converted mass of the pea starch.