

DESCRIPTION

TITLE OF INVENTION: OIL/FAT COMPOSITION FOR MEAT-LIKE PROCESSED FOOD

TECHNICAL FIELD

[0001]

The present invention relates to an oil-and-fat composition for a livestock meat-like processed food.

BACKGROUND ART

[0002]

Plant protein materials that have attracted attention in recent years are processed into various shapes such as a powder shape, a granular shape, and a specific textured shape depending on the application. Livestock meat-like processed foods using plant components such as plant based foods have been developed using these plant protein materials.

[0003]

Such livestock meat-like processed foods often use a binder or a gelling agent. An example thereof is egg white, and it is known that egg white has an action of enhancing binding properties of raw materials such as livestock meat. However, in designing a livestock meat-like processed food not using an animal component, it is necessary to use another binder.

[0004]

A technique using transglutaminase is disclosed as a technique focusing on binding properties in the production of a livestock meat-like processed food. Patent Literature 1 discloses that an oil-in-water emulsion containing transglutaminase is

prepared, a granular plant protein is immersed in the oil-in-water emulsion, and powdery plant protein is mixed, subjected to a crosslinking reaction, and heated to obtain a livestock processed food-like food having excellent binding properties. In addition, Patent Literature 2 discloses a plant protein processed food prepared by acting transglutaminase on an emulsion of plant protein and oil-and-fat. Patent Literature 3 discloses a method in which transglutaminase and a protease inhibitor are added to fish meat or livestock meat to perform an enzyme reaction in oil thereby to impart elasticity, pliability, juiciness, and the like to a fish meat or livestock meat paste product. Furthermore, Patent Literature 4 discloses a bakery-related food using an oil-and-fat composition containing oil-and-fat and transglutaminase at a high concentration of 1000 U per 100 g of the oil-and-fat.

CITATION LIST

PATENT LITERATURE

[0005]

Patent Literature 1: JP-A-2021-132587

Patent Literature 2: JP-A-10-56976

Patent Literature 3: JP-A-9-299065

Patent Literature 4: JP-A-2002-281897

SUMMARY OF INVENTION

PROBLEMS TO BE SOLVED BY INVENTION

[0006]

Patent Literatures 1 and 3 show that a processed food obtained through a specific process using transglutaminase has certain binding properties, but there is still room for improvement in the process. In Patent Literature 1, it is necessary to immerse granular soybean protein in an oil-in-water emulsion. In Patent Literature 3, heating is performed

in two stages. In consideration of the producing process, both the techniques of the patent literatures lack versatility. In addition, as described in Patent Literature 2, a plant protein processed food was produced by appropriately adding an auxiliary material to a product prepared by allowing transglutaminase to act on an emulsion obtained by blending plant protein and liquid oil as oil-and-fat, and binding properties, moldability, and texture were not good. Furthermore, in Patent Literature 4, the use of the oil-and-fat composition remains in bakery related foods.

Therefore, an object of the present invention is to produce a livestock meat-like processed food which is excellent in binding properties and moldability of a dough at the time of preparing the livestock meat-like processed food and has a good texture after heated.

SOLUTION TO PROBLEMS

[0007]

It has been found that by adding, to a dough of a livestock meat-like processed food, an oil-and-fat composition in which 0.1 to 5 U of transglutaminase with respect to 1 g of oil-and-fat is blended to oil-and-fat having a melting point of a certain level or higher, a livestock meat-like processed food which is rich in binding properties and moldability of a dough and has a good texture after heated is obtained. When coexisting with protein materials, transglutaminase causes an enzyme reaction, and is crosslinked to increase binding properties. On the other hand, if the enzyme reaction occurs too much, the mixture is excessively bound, and a livestock meat-like processed food blended with the mixture has a crumbly texture. When a processed food is produced, adjustment of this enzyme reaction affects the binding properties and moldability, and eventually the texture, and thus a technique is required. In the present invention, this point is solved by an oil-and-fat composition obtained by adding 0.1 to 5 U of transglutaminase with respect to 1 g

of oil-and-fat to oil-and-fat having a slip melting point of 2°C or higher.

[0008]

That is, the present invention relates to:

- (1) an oil-and-fat composition for a livestock meat-like processed food, including 0.1 to 5 U of transglutaminase with respect to 1 g of oil-and-fat in oil-and-fat having a slip melting point of 2°C or higher,
- (2) the oil-and-fat composition for a livestock meat-like processed food according to (1), in which a solid fat content (SFC) of the oil-and-fat at 10°C is 5% or more,
- (3) a method for producing a livestock meat-like processed food, the method including the steps of: mixing an oil-and-fat composition containing 0.1 to 5 U of transglutaminase with respect to 1 g of oil-and-fat and having a slip melting point of oil-and-fat of 2°C or higher and a raw material containing a plant protein material; molding a dough; and heating the molded dough,
- (4) the method for producing a livestock meat-like processed food according to (3), in which the plant protein material is a soybean protein material,
- (5) the method for producing a livestock meat-like processed food according to (3) or (4), in which egg white is not contained in the livestock meat-like processed food,
- (6) a method for producing an emulsion for a livestock meat-like processed food, including an oil-and-fat composition containing 0.1 to 5 U of transglutaminase with respect to 1 g of oil-and-fat in oil-and-fat having a slip melting point of 2°C or higher, a plant protein material, and water, and including a stirring step; and
- (7) a method for producing a livestock meat-like processed food, the method including the emulsion for a livestock meat-like processed food according to (6) in a raw material of the livestock meat-like processed food, and including the steps of: mixing the raw material; molding a dough; and heating the molded dough.

EFFECTS OF INVENTION

[0009]

By using the oil-and-fat composition for a livestock meat-like processed food of the present invention, it is possible to achieve both improvement in the productivity of the livestock meat-like processed food and improvement in the physical properties and texture. Specifically, an oil-and-fat composition obtained by adding 0.1 to 5 U of transglutaminase with respect to 1 g of oil-and-fat to oil-and-fat having a slip melting point of 2°C or higher appropriately advances the enzyme reaction by transglutaminase during dough preparation and heating of the livestock meat-like processed food. As the enzyme reaction proceeds appropriately, binding properties between the doughs are not excessively increased, and a dough having excellent moldability is obtained. In addition, appropriate elasticity can be imparted to the processed food after heated. In particular, when the plant protein material and the oil-and-fat composition contained in the processed food come into contact with each other in the dough of the processed food, the effect of the present invention is further exhibited.

DESCRIPTION OF EMBODIMENTS

[0010]

Hereinafter, the present invention will be specifically described.

[0011]

(Oil-and-fat)

As the oil-and-fat used in the present invention, any edible oil-and-fat can be used as long as the slip melting point is 2°C or higher. More preferably, the slip melting point is 8°C or higher, 10°C or higher, 13°C or higher, 15°C or higher, 20°C or higher, or 25°C or higher. Specific examples thereof include plant oils-and-fats such as palm oil, high erucic acid rapeseed oil, cottonseed oil, peanut oil, palm kernel oil, coconut oil, shea butter,

sal fat, rapeseed oil, sunflower oil, high oleic sunflower oil, soybean oil, rice oil, corn oil, safflower oil, safflower oil, olive oil, sesame oil, linseed oil, and medium-chain fatty acid triglyceride (MCT); animal oils-and-fats such as milk fat, beef tallow, lard, fish oil, and whale oil; animal and plant oils-and-fats such as alga oil and oil-and-fat derived from microbial fermentation; and fractionated oils, hydrogenated oils, and interesterified oils thereof. Two or more of these oils-and-fats may be mixed and used, as long as the slip melting point of the oil-and-fat to be used is 2°C or higher. By using an oil-and-fat having a slip melting point in this range, an enzyme reaction by transglutaminase appropriately occurs in the dough of the processed food, and binding properties, moldability, and texture of the processed food can be improved.

When animal oil-and-fat is not contained due to the product design of the livestock meat-like processed food, plant oil-and-fat is used as the oil-and-fat. In the present application, it is preferable to use plant oil-and-fat.

The slip melting point referred to in the present invention conforms to the method of Standard Methods for the Analysis of Fats, Oils and Related Materials 2.2.4.2 (1996) established by Japan Oil Chemists' Society.

[0012]

The oil-and-fat according to the present invention preferably has a slip melting point of 60°C or lower. The slip melting point is more preferably 55°C or lower, 50°C or lower, 40°C or lower, or 35°C or lower. The reaction optimum temperature of transglutaminase is around 55°C. When the oil-and-fat having a slip melting point of 60°C or lower is used, the enzyme reaction by transglutaminase occurs more appropriately, so that the binding properties, moldability, and texture of the processed food can be improved. When the slip melting point is higher than 60°C, the temperature exceeds the reaction optimum temperature of transglutaminase, so that the enzyme reaction may hardly occur. When the slip melting point exceeds 60°C, roughness or excessive oily feeling

may be felt when the processed food is eaten.

[0013]

The oil-and-fat according to the present invention preferably has a solid fat content (SFC) at 10°C of 5% or more. The SFC is more preferably 10% or more, 20% or more, 30% or more, 40% or more, 45% or more, 50% or more, or 55% or more. Further, more preferably, the upper limit is 90% or less, 85% or less, 80% or less, or 75% or less. When the oil-and-fat having an SFC at 10°C of 5% or more is used, the enzyme reaction by transglutaminase occurs appropriately, so that the binding properties, moldability, and texture of the processed food can be improved.

[0014]

The oil-and-fat according to the present invention preferably has an SFC at 30°C of 15% or less. More preferably, the upper limit is 12% or less, 10% or less, 8% or less, or 5% or less. More preferably, the lower limit is 0.1% or more or 0.5% or more. When the oil-and-fat having an SFC at 30°C of 15% or less is used, the enzyme reaction by transglutaminase occurs appropriately, so that the binding properties, moldability, and texture of the processed food can be improved.

[0015]

(Transglutaminase)

Transglutaminase is an enzyme that catalyzes an acyl transfer reaction of a γ -carboxamide group of a glutamine residue in a protein peptide chain. When this transglutaminase acts on an ϵ -amino group of a lysine residue in protein as an acyl receptor, an ϵ -(γ -Glu)Lys bond is formed in and between molecules of protein molecules, and crosslinking polymerization of protein in material protein as a main raw material is promoted, so that firm physical properties can be obtained.

As the transglutaminase according to the present invention, a commercially available preparation can be used. Examples thereof include "Activa Supercurd", "Activa

TG-S", and "Activa TG-S-NF" (all manufactured by Ajinomoto Co., Inc.). When the livestock meat-like processed food does not use an animal raw material, the type of preparation can be appropriately selected according to product design, such as using a lactose-free type as an excipient.

[0016]

Transglutaminase can react in a low temperature range of 2 to 10°C to a high temperature range of 65°C or lower. In order to improve working efficiency and obtain stronger binding properties, it is preferable to perform heating at 40 to 65°C, which is around the optimum temperature of transglutaminase. The temperature is more preferably 45 to 60°C. The reaction time is not particularly limited, but is 8 to 20 hours in a low temperature range and 10 to 120 minutes in a high temperature range. By performing the enzyme reaction in an appropriate temperature range, the enzyme reaction appropriately occurs, and the binding properties, moldability, and texture of the processed food can be improved

[0017]

(Addition amount of transglutaminase to oil-and-fat composition)

The oil-and-fat composition of the present invention is obtained by adding transglutaminase to the oil-and-fat. The addition amount of transglutaminase is appropriately adjusted depending on the enzyme content and activity in the preparation. The "Activa Supercurd" is a product containing 0.2% of transglutaminase and having a titer of 20 U/g. When other transglutaminase preparations are used, an appropriate amount can be used from the content and titer. When the above-described "Activa Supercurd" is used, 0.1 to 5 U is added to 1 g of the oil-and-fat. More preferably, the lower limit is 0.15 U or more, 0.2 U or more, 0.25 U or more, or 0.3 U or more with respect to 1 g of the oil-and-fat. More preferably, the upper limit is 4.8 U or less, 4.5 U or less, 4 U or less, 3.5 U or less, or 3 U or less with respect to 1 g of the oil-and-fat. When

the addition amount of transglutaminase is appropriate, the enzyme reaction by transglutaminase occurs appropriately. Then, the binding properties, moldability, and texture of the processed food can be improved. When an amount of less than 0.1 U is blended, the effect of the present invention may not be sufficiently obtained. When the blending amount is more than 5U, the doughs are excessively bound to each other, so that there is a case where the processed food cannot be molded or has a rough texture.

[0018]

(Livestock meat-like processed food)

The livestock meat-like processed food according to the present invention is a processed food in which a plant protein material is blended. An animal material may be appropriately used according to the product design and concept of the livestock meat-like processed food. A livestock meat-like processed food which uses only a plant protein material without using an animal material is particularly a processed food called meatless. The plant protein material is preferably contained in the livestock meat-like processed food in an amount of 0.1 mass% or more by dry weight. The content is more preferably 0.5 mass% or more, 1 mass% or more, 2 mass% or more, 3 mass% or more, 5 mass% or more, 8 mass% or more, 10 mass% or more, 12 mass% or more, or 15 mass% or more. More preferably, the upper limit is 50 mass% or less, 45 mass% or less, 40 mass% or less, 35 mass% or less, or 30 mass% or less.

[0019]

(Plant protein material)

As the plant protein material according to the present invention, a material suitable for a product form of processed food, such as granular plant protein, powdery plant protein, emulsion curd, or the like, can be appropriately used.

The granular plant protein that can be used as the plant protein material according to the present invention is obtained by blending a plant raw material exemplified by

soybean, soybean protein, wheat, wheat protein, pea, or pea protein, and texturizing the raw material under high temperature and high pressure using a texturization device such as an extruder, and has a granular shape, a flake shape, a slice shape, and the like. Granular soybean protein containing soybean as a main raw material is suitable for the present invention. A product having an optional shape or size can be appropriately selected and used according to a desired product form.

[0020]

The powdery plant protein that can be used as the plant protein material according to the present invention is obtained by powdering a plant raw material exemplified by soybean, wheat, pea, or the like, and contains 50 mass% or more of protein per solid content. Soy, particularly defatted soy, is suitable for the present invention. A commercially available powdery plant protein can be appropriately selected and used. The powdery plant protein can also be added with oil-and-fat in advance and powdered for use in order to enhance dispersibility in the dough. An emulsion curd using powdery plant protein can also be used as a plant protein material. The emulsion curd as used herein refers to an emulsion containing powdery plant protein, water, and oil-and-fat and being homogenized. Also in this case, powdery soybean protein is suitable.

[0021]

(Animal material)

The livestock meat-like processed food according to the present invention may use an animal material. The animal material referred to herein refers to a material derived from birds and animals, such as livestock meat, animal oil-and-fat, and egg white. If a processed food does not contain an animal material, the processed food does not contain any animal material and uses only a plant material.

As the livestock meat, meat derived from birds and animals such as cattle, pigs, chickens, horses, sheep, deer, boars, turkeys, ducks, ostriches, and whale can be used

singly or in combination of two or more kinds thereof. In the present invention, the origin of the livestock meat species and the site of the livestock meat are not particularly limited, but land organisms are preferable. When the livestock meat is blended into the processed food, the content is preferably 80 mass% or less in the processed food. The content is more preferably 70 mass% or less, 60 mass% or less, 50 mass% or less, 40 mass% or less, 30 mass% or less, 20 mass% or less, 10 mass% or less, 5 mass% or less, 1 mass% or less, or 0 mass%. When it is blended within this range, the effect of the present invention can be exhibited.

The content of the animal oil-and-fat is preferably 30 mass% or less in the processed food. The content is more preferably 25 mass% or less, 20 mass% or less, 15 mass% or less, 10 mass% or less, 5 mass% or less, 3 mass% or less, 1 mass% or less, or 0 mass%. The content is mass% or less, 5 mass% or less, 3 mass% or less, 1 mass% or less, or 0 mass%.

[0022]

The livestock meat-like processed food according to the present invention may contain egg white. More preferably, egg white is not contained. The egg white referred to herein may be raw egg white, powdered egg white, dried egg white, or the like.

[0023]

(Specific examples of livestock meat-like processed food)

Specific examples of the livestock meat-like processed food according to the present invention include processed foods using ground meat such as Hamburg steak, patties, meatballs, nuggets, chicken meatballs, ham, salami, sausage, meat dumplings, steamed dumplings, steamed meat buns, soup dumplings, ground-meat croquettes, croquettes, Frankfurt sausage, corn dogs, meat pie, ravioli, lasagna, meat loaf, meat-stuffed cabbage, meat filling of bell pepper, lotus root, and others, and molded meat lump processed foods such as fried foods such as cutlets, nuggets, and fried chicken, baked

foods such as sauté, steak, and broiled meat, and steamed foods such as char siu and steamed chicken breast.

[0024]

(Method for producing oil-and-fat composition)

An example of a method for producing the oil-and-fat composition for a livestock meat-like processed food of the present invention will be described. Transglutaminase is added to oil-and-fat and mixed with a mixing machine or the like to obtain an oil-and-fat composition. Examples of the mixing machine include stirring and mixing with a spatula, a mixer, and the like. The oil-and-fat composition obtained by mixing may be then subjected to a kneading treatment with a combinator or the like. The oil-and-fat composition obtained by mixing may contain an inert gas. In this case, the amount of the inert gas is preferably 5 to 20 vol% in the oil-and-fat. More preferably, the lower limit is 8 vol% or more, or 12 vol% or more. More preferably, the upper limit is 17 vol% or less, or 15 vol% or less. As the inert gas, nitrogen, argon, helium, carbon dioxide, and a mixture of these inert gases can be used.

Water, an emulsifier, a flavor, a seasoning, and the like may be blended in the oil-and-fat composition to such an extent that the effect of the present invention is not hindered.

[0025]

(Method for producing livestock meat-like processed food)

An example of a method for producing the livestock meat-like processed food of the present invention will be described. First, the oil-and-fat composition, the plant protein material, and other raw materials necessary for the livestock meat-like processed food are mixed. The oil-and-fat composition may be mixed after being chopped before being mixed with the plant protein material and other raw materials. Alternatively, the oil-and-fat composition may be added simultaneously with the plant protein material and

other raw materials, and then chopped by a mixing machine. In one embodiment, as will be described later, a method of adding, as a raw material of the livestock meat-like processed food, an emulsion (emulsion curd) for a livestock meat-like processed food obtained by stirring a plant protein material, water, and the oil-and-fat composition is preferable. As the mixing machine, any mixing machine such as a mixer, a Robot Coupe, or a silent cutter can be used.

[0026]

Next, the dough obtained by mixing is molded. The molded dough is heated. A specific example is a heat treatment in which the mixed dough is molded into a specific shape and heated by steaming, frying, baking or the like to be heat-set. Through all these steps, a molded dough having appropriate binding properties is obtained, and a livestock meat-like processed food having good moldability and texture is obtained.

[0027]

In the livestock meat-like processed food of the present invention, raw materials blended in general livestock meat processed products, such as saccharides containing various starches, emulsifiers, binders, thickening stabilizers, salts, seasonings, spices, acidulants, colorants, preservatives, coloring agents, pH adjusters, and antioxidants, can be appropriately used in addition to the above-described materials, as long as the effect of the present invention is not inhibited. Of course, the oil-and-fat composition for a livestock meat-like processed food of the present invention can also be applied to seafood processed foods including fish meat.

[0028]

(Emulsion for livestock meat-like processed food)

The present invention can also be used in a method for producing an emulsion (emulsion curd) for a livestock meat-like processed food including an oil-and-fat composition containing 0.1 to 5 U of transglutaminase with respect to 1 g of oil-and-fat in

oil-and-fat having a slip melting point of 2°C or higher, a plant protein material, and water. Preferably, the emulsion is an oil-in-water emulsion. Specifically, the oil-and-fat composition can be used as a raw material of an emulsion curd. By adding the emulsion to a livestock meat-like processed food, a molded dough having appropriate binding properties can be obtained, and a livestock meat-like processed food having good moldability and texture can be obtained. As an example of the method for producing the emulsion, the following method can be presented. A plant protein material is added to water and stirred, and the oil-and-fat composition is added thereto and further stirred to obtain the emulsion. For stirring, a mixing machine such as a Robot Coupe can be used. The emulsion preferably contains 5 to 50 mass% of the oil-and-fat composition. The content is more preferably 6 to 48 mass%, still more preferably 8 to 45 mass%. The method for producing a processed food containing the emulsion is as described above.

[0029]

(Other raw materials)

Known materials and food additives can be used depending on the type of the livestock meat processed food or the livestock meat-like processed food according to the present invention. For example, plants, tallow such as lard, plant oil, starch, seasoning (salt, pepper, sugar, soy sauce or the like), processed starch, egg yolk, egg white, emulsifier, spice, flavor, and other known additives can be appropriately used as long as the effect of the present invention is not hindered.

EXAMPLES

[0030]

Hereinafter, the present invention will be described in more detail, but the spirit of the present invention is not limited to the following examples. It is noted that the terms "part" and "%" in the text are on a mass basis unless otherwise stated.

[0031]

The oil-and-fat was analyzed as follows. The slip melting point was measured according to Standard Methods for the Analysis of Fats, Oils and Related Materials 2.2.4.2 (1996) established by Japan Oil Chemists' Society. The SFCs at 30°C and 10°C were measured in accordance with the method of IUPAC. 2 150 (a) Solid Content Determination In Fats By NMR. That is, each oil-and-fat was held in an environment at 80°C for 30 minutes, held in an environment at 60°C for 30 minutes to be completely melted, and then held in an environment at 0°C for 60 minutes to be solidified. Thereafter, the solid fat content after being held in an environment at 30°C or 10°C for 30 minutes was measured by NMR ("minispec mq 20" manufactured by Bruker Corporation).

[0032]

(Examination 1) Production of oil-and-fat composition for a livestock meat-like processed food

According to the formulations in Table 1, oil-and-fat compositions for a livestock meat-like processed food were prepared. Each of oils-and-fats A to E was dissolved, a transglutaminase preparation was added thereto, and the mixture was stirred with a homomixer to obtain each of oil-and-fat compositions A to E. The amount of transglutaminase in each of the oil-and-fat compositions A to E was 1 U with respect to 1 g of oil-and-fat. The melting point and SFC of each of the oils-and-fats used are shown in Table 2.

-Oil-and-fat A: "Parkid P" (manufactured by Fuji Oil Co., Ltd.)

-Oil-and-fat B: "Refined Coconut Oil" (manufactured by Fuji Oil Co., Ltd.)

-Oil-and-fat C: "Unishort MJ" (manufactured by Fuji Oil Co., Ltd.)

-Oil-and-fat D: "Unishort FT" (manufactured by Fuji Oil Co., Ltd.)

-Oil-and-fat E: "Rapeseed Oil" (manufactured by Fuji Oil Co., Ltd.)

-Transglutaminase preparation: "Activa Supercurd" (Transglutaminase content: 0.2%,

titer: 20 U/g, manufactured by Ajinomoto Co., Inc.)

[0033]

(Table 1) Formulations of oil-and-fat compositions

[mass%]		Oil-and-fat composition A	Oil-and-fat composition B	Oil-and-fat composition C	Oil-and-fat composition D	Oil-and-fat composition E
Oil-and-fat	Oil-and-fat A	95	-	-	-	-
	Oil-and-fat B	-	95	-	-	-
	Oil-and-fat C	-	-	95	-	-
	Oil-and-fat D	-	-	-	95	-
	Oil-and-fat E	-	-	-	-	95
Transglutaminase preparation		5	5	5	5	5
Transglutaminase [U/1g of Oil-and-fat] in oil-and-fat composition		1	1	1	1	1

[0034]

(Table 2) Melting points and SFCs of used oils-and-fats

	Slip melting point [°C]	SFC [%] at 10°C	SFC [%] at 30°C
Oil-and-fat A	39	53	7.2
Oil-and-fat B	24	85	0.1
Oil-and-fat C	26	71	0.7
Oil-and-fat D	49	11	6.5
Oil-and-fat E	0	0	0

[0035]

(Examination 2) Production 1 of livestock meat-like processed food: Examination of dough moldability

Using the oil-and-fat compositions A to E, livestock meat-like processed foods were produced according to the following method.

○Preparation of emulsion curds

Emulsion curds were prepared according to the formulations in Table 3. A soybean protein material ("New Fujipro FR" manufactured by Fuji Oil Co., Ltd.) was added to water and stirred for 3 minutes, and oil-and-fat A or each of oil-and-fat compositions A to E was added thereto and stirred for 5 minutes to obtain an emulsion curd according to each of Comparative Examples 1-1 to 1-3 and Examples 1-1 to 1-4.

Comparative Example 1-2 was prepared by simultaneously adding a transglutaminase preparation ("Activa Supercurd") together with oil-and-fat A. The obtained emulsion curd was stored under refrigeration (5°C) for 0 minute, 30 minutes, 60 minutes, and 120 minutes. It is to be noted that a Robot coupe (manufactured by FMI Corporation) was used for stirring.

[0036]

(Table 3) Formulations of emulsion curds

[mass%]	Comparative Example 1-1	Comparative Example 1-2	Example 1-1	Example 1-2	Example 1-3	Example 1-4	Comparative Example 1-3
Oil-and-fat A	9.1	9.1	-	-	-	-	-
Oil-and-fat composition A	-	-	9.1	-	-	-	-
Oil-and-fat composition B	-	-	-	9.1	-	-	-
Oil-and-fat composition C	-	-	-	-	9.1	-	-
Oil-and-fat composition D	-	-	-	-	-	9.1	-
Oil-and-fat composition E	-	-	-	-	-	-	9.1
Powdery soybean protein material	18.2	18.2	18.2	18.2	18.2	18.2	18.2
Water	72.7	72.25	72.7	72.7	72.7	72.7	72.7
Transglutaminase preparation	-	0.45	-	-	-	-	-
Transglutaminase [U/1g of Oil-and-fat] in emulsion curd	0	0.09	0.09	0.09	0.09	0.09	0.09

[0037]

○Preparation of livestock meat-like processed food

According to the formulations in Table 4 (upper rows), fried pork cutlet-like food was prepared as the livestock meat-like processed food using the emulsion curds of Comparative Examples 1-1 to 1-3 and Examples 1-1 to 1-4.

Each emulsion curd stored for each time was placed in a food processor, and a textured plant protein material ("Apex 1000" manufactured by Fuji Oil Co., Ltd.) to which water had been added in advance to increase twofold, soy sauce, sake, ginger, sugar, salt, and seasoning were added thereto. The mixture was stirred in the food processor to obtain a dough of a fried pork cutlet-like food according to each of Comparative Examples 2-1, 2-3, and 2-4 and Examples 2-1 to 2-4. In addition, the emulsion curd of Comparative Example 1-1 stored for each time and a transglutaminase preparation ("Active Supercurd") were put in a food processor and stirred, and a water-added textured plant protein material,

soy sauce, sake, ginger, sugar, salt, and seasoning were added thereto. The mixture was stirred again in the food processor to obtain a dough of a fried pork cutlet-like food of Comparative Example 2-2.

Each of the obtained doughs was molded into a size of 5 cm × 9 cm × 1 cm to obtain a molded product of a fried pork cutlet-like food.

[0038]

(Table 4) Formulations of livestock meat-like processed foods and evaluation results of moldability

Formulation [mass%]		Comparative Example 2-1	Comparative Example 2-2	Comparative Example 2-3	Example 2-1	Example 2-2	Example 2-3	Example 2-4	Comparative Example 2-4
		31.9	31.75	-	-	-	-	-	-
Emulsion curd stored for each time	Comparative Example 1-1	-	-	31.9	-	-	-	-	-
	Comparative Example 1-2	-	-	-	-	-	-	-	-
	Example 1-1	-	-	-	31.9	-	-	-	-
	Example 1-2	-	-	-	-	31.9	-	-	-
	Example 1-3	-	-	-	-	-	31.9	-	-
Transglutaminase preparation	Example 1-4	-	-	-	-	-	-	31.9	-
	Comparative Example 1-3	-	-	-	-	-	-	-	31.9
		-	0.15	-	-	-	-	-	-
		60	60	60	60	60	60	60	60
	Textured plant protein material (after twofold water addition)	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
Soy sauce		1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
	Sake	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1
	Ginger	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
	Sugar	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
	Salt	2	2	2	2	2	2	2	2
Seasoning		0	0.03	0.03	0.03	0.03	0.03	0.03	0.03
	Transglutaminase [U/1g of Oil-and-fat] in livestock meat-like processed food								
Evaluation of moldability									
Reaction time of emulsion curd	0 min	5	5	5	5	5	5	5	5
	30 mins	4	4	4	4	4	4	4	4
	60 mins	4	1	1	3	3	4	3	2
	120 mins	4	0	0	2	2	3	2	1
	Comprehensive evaluation	Acceptable	Rejection	Rejection	Acceptable	Acceptable	Acceptable	Acceptable	Rejection

[0039]

(Evaluation of moldability)

The moldability of the dough of the fried pork cutlet-like food was evaluated. The evaluation points were as follows. Those having two or more points in evaluation at each reaction time were regarded acceptable as comprehensive evaluation. The results are shown in Table 4 (lower rows).

5 points: It can be easily molded.

4 points: It can be molded.

3 points: It can be generally molded.

2 points: Slightly difficult, but it can be molded.

1 point: It cannot be molded.

0 point: It cannot be molded at all.

[0040]

In Comparative Example 2-1, a livestock meat-like processed food including the emulsion curd having a reaction time of 0 minute could be easily molded. It was also possible to easily mold a livestock meat-like processed food including the emulsion curd after the reaction time lapsed 30 minutes, 60 minutes, or 120 minutes. In Comparative Example 2-2 and Comparative Example 2-3, a livestock meat-like processed food including the emulsion curd having a reaction time of 0 minute could be easily molded. As the reaction time was longer, molding was impossible, or moldability was poor. Further, in Comparative Example 2-4 in which the oil-and-fat composition E obtained by adding transglutaminase to oil-and-fat having a slip melting point of lower than 2°C was blended, it was harder to perform molding as the reaction time elapsed, and molding could not be performed when the emulsion curd after 120 minutes of the reaction was used.

In Examples 2-1 to 2-4, a livestock meat-like processed food including the emulsion curd having a reaction time of 0 minute could be easily molded. It was also

possible to mold a livestock meat-like processed food including the emulsion curd after the reaction time lapsed 30 minutes. It was also generally possible to mold a livestock meat-like processed food including the emulsion curd after a lapse of 60 minutes. Even a livestock meat-like processed food including the emulsion curd after a lapse of 120 minutes could be molded with slight difficulty. In particular, the moldability was the best in a livestock meat-like processed food using the emulsion curd of Example 1-3 (Example 2-3). From the above, it was confirmed that even when the reaction time of transglutaminase is long, the oil-and-fat composition of the present invention imparts appropriate binding properties to a dough by the formulation thereof, and has good moldability.

[0041]

(Examination 3) Production 2 of livestock meat-like processed food: Examination of texture

Emulsion curds of Comparative Example 3-1 and Examples 3-1 to 3-4 were prepared according to the formulations in Table 5. A powdery soybean protein material ("New Fujipro FR" manufactured by Fuji Oil Co., Ltd.) was added to water and stirred for 3 minutes, and oil-and-fat A or each of oil-and-fat compositions A to D was added thereto and stirred for 5 minutes to obtain an emulsion curd according to each of Comparative Example 3-1 and Examples 3-1 to 3-4. In the emulsion curds of Examples 3-1 to 3-4, 0.09 U of transglutaminase was contained with respect to 1 g of oil-and-fat.

- Transglutaminase preparation: "Activa Supercurd" (Transglutaminase content: 0.2%, titer: 20 U/g, manufactured by Ajinomoto Co., Inc.)

[0042]

(Table 5) Formulations of emulsion curds

[mass%]	Comparative Example 3-1	Example 3-1	Example 3-2	Example 3-3	Example 3-4
Oil-and-fat A	9.1	-	-	-	-
Oil-and-fat composition A	-	9.1	-	-	-
Oil-and-fat composition B	-	-	9.1	-	-
Oil-and-fat composition C	-	-	-	9.1	-
Oil-and-fat composition D	-	-	-	-	9.1
Powdery soybean protein material	18.2	18.2	18.2	18.2	18.2
Water	72.7	72.7	72.7	72.7	72.7
Transglutaminase [U/1g of Oil-and-fat] in emulsion curd	0	0.09	0.09	0.09	0.09

[0043]

○Preparation of livestock meat-like processed food

Doughs of fried pork cutlet-like foods of Comparative Example 4-1 and Examples 4-1 to 4-4 were obtained according to the formulations in Table 6 (upper rows). Each of the emulsion curds of Comparative Example 3-1 and Examples 3-1 to 3-4 was placed in a food processor, and a textured plant protein material ("Apex 1000" manufactured by Fuji Oil Co., Ltd.) to which water had been added in advance to increase twofold, soy sauce, sake, ginger, sugar, salt, and seasoning were added thereto. The mixture was stirred in the food processor to obtain a dough of a fried pork cutlet-like food according to each of Comparative Example 4-1 and Examples 4-1 to 4-4. Each of the obtained doughs was molded into a size of 5 cm × 9 cm × 1 cm, and then an enzyme reaction time was set under two conditions of (a) storing overnight in a refrigerator and (b) storing at 50°C for 1 hour. The molded product stored under each condition was heated at 90°C for 30 minutes, then coated with a batter and breadcrumbs, and then cooked with rapeseed oil at 175°C for 4 to 6 minutes to obtain a fried pork cutlet-like food. In the emulsion curd of the present examination, the enzyme reaction time was not set in advance.

[0044]

(Table 6) Formulations of livestock meat-like processed foods and evaluation results of texture

			Comparative Example 4-1	Example 4-1	Example 4-2	Example 4-3	Example 4-4
Formulation [mass%]	Emulsion curd	Comparative Example 3-1	31.9	-	-	-	-
		Example 3-1	-	31.9	-	-	-
		Example 3-2	-	-	31.9	-	-
		Example 3-3	-	-	-	31.9	-
		Example 3-4	-	-	-	-	31.9
	Textured plant protein material (after twofold water addition)		60	60	60	60	60
	Soy sauce		1.5	1.5	1.5	1.5	1.5
	Sake		1.5	1.5	1.5	1.5	1.5
	Ginger		1.1	1.1	1.1	1.1	1.1
	Sugar		1.5	1.5	1.5	1.5	1.5
	Salt		0.5	0.5	0.5	0.5	0.5
	Seasoning		2	2	2	2	2
	Transglutaminase [U/1g of Oil-and-fat] in livestock meat-like processed food		0	0.03	0.03	0.03	0.03
Evaluation of texture							
(a) Heated at 90°C for 30 mins after stored overnight in a refrigerator			1	5	5	5	5
(b) Heated at 90°C for 30 mins after stored at 50°C for 1 hour			1	5	5	5	5
Comprehensive evaluation			Rejection	Acceptable	Acceptable	Acceptable	Acceptable

[0045]

(Evaluation of texture)

Evaluation was performed by five skilled panelists engaged in the work of processed foods, and evaluation was made by consultation based on the following criteria. For both (a) and (b), those having two or more points were regarded acceptable as comprehensive evaluation. The results are shown in Table 6 (lower rows).

5 points: It is firmly bound and has a hard texture.

4 points: It is generally firmly bound and has a hard texture.

3 points: It is bound and has a hard texture.

2 points: It is weakly bound and has a soft texture.

1 point: It is not bound and has a soft texture.

[0046]

The livestock meat-like processed food not containing transglutaminase of Comparative Example 4-1 had a soft texture. On the other hand, all of the livestock meat-

like processed foods containing the oil-and-fat compositions of Examples 4-1 to 4-4 were firmly bound and had a hard texture.

Therefore, it was confirmed that an oil-and-fat composition for a livestock meat-like processed food, containing oil-and-fat having a slip melting point of 2°C or higher and 0.1 to 5 U of transglutaminase with respect to 1 g of oil-and-fat, can improve all of the binding properties, moldability, and texture of the livestock meat-like processed food.

CLAIMS

[Claim 1] An oil-and-fat composition for a livestock meat-like processed food, comprising 0.1 to 5 U of transglutaminase with respect to 1 g of oil-and-fat in oil-and-fat having a slip melting point of 2°C or higher.

[Claim 2] The oil-and-fat composition for a livestock meat-like processed food according to claim 1, wherein a solid fat content (SFC) of the oil-and-fat at 10°C is 5% or more.

[Claim 3] A method for producing a livestock meat-like processed food, comprising steps of: mixing an oil-and-fat composition containing 0.1 to 5 U of transglutaminase with respect to 1 g of oil-and-fat and having a slip melting point of oil-and-fat of 2°C or higher and a raw material containing a plant protein material; molding a dough; and heating the molded dough.

[Claim 4] The method for producing a livestock meat-like processed food according to claim 3, wherein the plant protein material is a soybean protein material.

[Claim 5] The method for producing a livestock meat-like processed food according to claim 3 or 4, wherein the livestock meat-like processed food does not contain egg white.

[Claim 6] A method for producing an emulsion for a livestock meat-like processed food comprising an oil-and-fat composition containing 0.1 to 5 U of transglutaminase with respect to 1 g of oil-and-fat in oil-and-fat having a slip melting point of 2°C or higher, a plant protein material, and water, and including a stirring step.

[Claim 7] A method for producing a livestock meat-like processed food, the method comprising the emulsion for a livestock meat-like processed food according to claim 6 in a raw material of the livestock meat-like processed food, and including steps of: mixing the raw material, molding a dough, and heating the molded dough.