

DESCRIPTION

UMAMI-ENHANCING COMPOSITION AND METHOD FOR MANUFACTURING SAME,
SEASONING OR EXTRACT AND METHOD FOR MANUFACTURING SAME, OIL
AND FAT COMPOSITION FOR COOKING WITH HEAT AND METHOD FOR
5 MANUFACTURING SAME, AND METHOD FOR ENHANCING *UMAMI* OF FOOD

PRODUCT

TECHNICAL FIELD

[0001]

The present invention relates to a palm-based oil and fat
10 oxidation treatment product having an exceptional effect for
enhancing *umami*, and to a use of said oxidation treatment
product.

BACKGROUND ART

[0002]

15 The five original flavors that form a basis for tasting
food products (basic flavors) are sweetness, sourness,
saltiness, bitterness, and *umami*. Enhancing or reducing these
flavors in food products raises the tastiness of the food
products, it being desirable to enhance *umami*.

20 [0003]

Patent Document 1 (International Publication No.
2011/030650) discloses adding a specific aldehyde or a
specific alcohol to an aqueous solution of monosodium
glutamate, which is an *umami* component, whereby *umami* is
25 enhanced.

[Related Art Documents]

[Patent Documents]

[0004]

[Patent Document 1] International Publication No.
2011/030650

5 DISCLOSURE OF THE INVENTION

[Problems the Invention is Intended to Solve]

[0005]

 However, in view of the preferences of consumers and the
increasingly diverse needs of enterprises involved in the
10 foodstuffs trade, it has become desirable to provide novel
ingredients of non-conventional origin.

[0006]

 It is accordingly an object of the present invention to
provide an edible ingredient having an exceptional effect for
15 enhancing *umami*.

[Means for Solving the Problems]

[0007]

 According to a first aspect of the present invention,
there is provided an *umami*-enhancing composition having an
20 oxidation treatment product of a palm-based oil and fat as an
active ingredient.

[0008]

 In the *umami*-enhancing composition described above, the
peroxide value of the oxidation treatment product is
25 preferably 3 or greater and 250 or lower.

[0009]

In the *umami*-enhancing composition described above, the total α -carotene and β -carotene content of the palm-based oil and fat is preferably 30 mass ppm or more and 2000 mass ppm or less.

5 [0010]

The *umami*-enhancing composition described above is preferably in the form of an edible oil and fat composition.

[0011]

According to a second aspect of the present invention,
10 there is provided a seasoning or extract that contains the *umami*-enhancing composition described above.

[0012]

According to a third aspect of the present invention,
there is provided an oil and fat composition for cooking with
15 heat that contains the *umami*-enhancing composition described above.

[0013]

According to a fourth aspect of the present invention,
there is provided a method for manufacturing a heat-cooked
20 food, the method being characterized in that a food is cooked with heat using the oil and fat composition for cooking with heat described above.

[0014]

According to a fifth aspect of the present invention,
25 there is provided a method for manufacturing an *umami*-enhancing composition, the method including a step in which a

palm-based oil and fat in which the total α -carotene and β -carotene content is 30 mass ppm or more and 2000 mass ppm or less is subjected to an oxidation treatment such that the peroxide value reaches 3 or greater and 250 or lower.

5 [0015]

In the method for manufacturing an *umami*-enhancing composition described above, the oxidation treatment is preferably carried out through heat treatment at 50°C or greater and 220°C or lower for 0.1 hour or more and 240 hours
10 or less.

[0016]

In the method for manufacturing an *umami*-enhancing composition described above, the heat treatment preferably involves supplying oxygen.

15 [0017]

In the method for manufacturing an *umami*-enhancing composition described above, it is preferable that, after the step for conducting an oxidation treatment has been completed, there is furthermore included a step for mixing with an edible
20 oil and fat.

[0018]

According to a sixth aspect of the present invention, there is provided a method for manufacturing a seasoning or extract, the method including a step for mixing an *umami*
25 component and an *umami*-enhancing composition obtained through the method for manufacturing an *umami*-enhancing composition

described above.

[0019]

According to a seventh aspect of the present invention,
there is provided a method for enhancing the *umami* of a food
5 product, the method involving imparting the *umami*-enhancing
composition described above to a food product.

[0020]

In the method for enhancing the *umami* of a food product
described above, the oxidation treatment product is preferably
10 incorporated into the food product in an amount of 1×10^{-6} mass
ppm or more and 1000 mass ppm or less.

[Effect of the Invention]

[0021]

According to the present invention, it is possible to
15 provide an edible ingredient that has an exceptional effect
for enhancing *umami* and that is derived from palm-based oil
and fat.

MODE FOR CARRYING OUT THE INVENTION

[0022]

20 The palm-based oil and fat used in the present invention
is preferably obtained from oil palm fruit, and may be
subjected to treatments such as molecular distillation,
fractionation, degumming, deacidification, decoloration, and
deodorization. The methods for carrying out these treatments
25 are not particularly limited; methods that are used in
processing/purification treatment of oils and fats can

generally be employed. For example, fractionation can be carried out through solvent fractionation or low-temperature filtration. However, the total α -carotene and β -carotene content is preferably 30 mass ppm or more and 2000 mass ppm or less, more preferably 50 mass ppm or more and 1500 mass ppm or less, even more preferably 50 mass ppm or more and 1000 mass ppm or less, and particularly preferably 50 mass ppm or more and 800 mass ppm or less. One type of palm-based oil and fat may be used alone such that the total α -carotene and β -carotene content is within the ranges described above, or two or more types of palm-based oil and fat may be used in combination such that these ranges are reached.

[0023]

In the present invention, the palm-based oil and fat is subjected to an oxidation treatment to obtain an oxidation treatment product thereof. The peroxide value (also referred to as "POV" below) of the oxidation treatment product is preferably 3 or greater and 250 or lower, more preferably 3 or greater and 220 or lower, even more preferably 3 or greater and 180 or lower, and particularly preferably 3 or greater and 150 or lower. The POV can be measured in conformance with "Standard methods for the analysis of fats, oils and related materials: 2.5.2 Peroxide value" (Japan Oil Chemists' Society). Carrying out an oxidation treatment so as to reach a POV within the prescribed ranges above makes it possible to obtain an edible ingredient having an exceptional effect for

enhancing *umami*.

[0024]

There is no particular limitation as to the method for carrying out the oxidizing treatment on the palm-based oil and fat; it is preferable to employ a method with which it is possible to achieve the POV in the prescribed ranges, preferably a heat treatment. From the standpoint of production on an industrial scale, it is preferable to accommodate the palm-based oil and fat in a suitable container, such as a tank, and then carry out the heat treatment using heating means that heats via, e.g., thermoelectric conversion, direct-flame burners, microwaves, steam, or hot blasts of air, said heating means being provided to the container. There is no particular limitation as to the conditions of the heat treatment; however, the heat treatment is preferably carried out at a heating temperature of 50°C or greater and 220°C or lower for a heating time of 0.1 hour or more and 240 hours or less, and more preferably carried out at a heating temperature of 60°C or greater and 160°C or lower for a heating time of 1 hour or more and 100 hours or less. As conditions for an integral amount obtained by multiplying heating temperature (°C) by heating time (hours), it is typical to perform the heat treatment using an integral amount of 200 or more and 20000 or less, more typical to perform the heat treatment using an integral amount of 220 or more and 18000 or less, and even more typical to perform the heat treatment using an

integral amount of 240 or more and 15000 or less. When the heating temperature is changed, the integral amount obtained by multiplying heating temperature (°C) by heating time (hours) can be calculated as the sum of the product of the heating temperature (°C) before the change in temperature and the heating time (hours) before the change in temperature and the product of the heating temperature (°C) after the change in temperature and the heating time (hours) after the change in temperature, or as an integral value of the heating temperature (°C) over the heating time (hours).

[0025]

During the heat treatment, oxygen may be taken in from an open space in the container by stirring, or oxygen may be blown in, to supply the oxygen (air). Air, etc., may be used as an oxygen source. This promotes oxidation of the palm-based oil and fat. In this case, the amount of oxygen supplied is preferably set so as to reach 0.001-2 L/min per kilogram of the palm-based oil and fat. For example, when air is used, the amount supplied is preferably 0.005-10 L/min, and even more preferably 0.01-5 L/min, per kilogram of the palm-based oil and fat.

[0026]

Another suitable edible oil and fat may be mixed, as appropriate, into the product of the oxidation treatment performed on the palm-based oil and fat obtained as described above, within a range in which the desired function of

enhancing *umami* is not hindered, and an oil and fat composition that is obtained by incorporating the oxidation treatment product of the palm-based oil and fat may be formed. Examples of the other edible oil and fat include: soybean oil, rapeseed oil (canola oil), palm oil, corn oil, olive oil, sesame oil, safflower oil, sunflower oil, cottonseed oil, rice bran oil, peanut oil, palm kernel oil, coconut oil, and other vegetable oils and fats; beef tallow, lard, chicken fat, milk fat, and other animal oils and fats; and medium-chain fatty acid triglycerides, or processed oils and fats obtained by implementing fractionation, hydrogenation, transesterification, etc., on these oils and fats. One of the other edible oils and fats may be used alone, or two or more thereof may be used in combination. There is no particular limitation as to the blending ratio; however, from the standpoint of not hindering the desired function for enhancing *umami*, the amount of the oxidation treatment product of the palm-based oil and fat contained with respect to the total of the oxidation treatment product of the palm-based oil and fat and the other edible oil and fat is preferably 1×10^{-5} mass% or more and less than 100 mass%, more preferably 1×10^{-4} mass% or more and less than 100 mass%, even more preferably 1×10^{-3} mass% or more and less than 100 mass%, and particularly preferably 1×10^{-2} mass% or more and less than 100 mass%. During blending of the oil and fat composition, one oxidation treatment product of the palm-based oil and fat may be incorporated

alone into the other edible oil and fat, or two or more thereof may be used in combination.

[0027]

Furthermore, suitable additives may be blended, as appropriate, into the oxidation treatment product of the palm-based oil and fat obtained as described above or into the oil and fat composition in which the same is incorporated, within a range in which the desired function of enhancing *umami* is not hindered. Specific examples include: fatty acid esters of ascorbic acid, lignans, coenzyme Q, γ -oryzanol, tocopherol, and other antioxidants; spices, spice extracts, animal essences, fatty acids, and other flavor-imparting ingredients; emulsifiers; silicone; and pigments.

[0028]

In the present invention, the oxidation treatment product of the palm-based oil and fat and the oil and fat composition containing the same are used in enhancing *umami*, and specifically are used as active ingredients of an *umami*-enhancing composition.

[0029]

In the *umami*-enhancing composition according to the present invention, the amount of the oxidation treatment product of the palm-based oil and fat therein is preferably determined, as appropriate, from the standpoint of reaching a desired optimal amount during application, and there is no particular limitation as to this amount. However, this amount

is preferably 1×10^{-5} mass% or more and 100 mass% or less, more preferably 1×10^{-4} mass% or more and 100 mass% or less, even more preferably 1×10^{-3} mass% or more and 100 mass% or less, and particularly preferably 1×10^{-2} mass% or more and 100 mass% or less.

[0030]

In a discretionary non-limiting mode of the present invention, the *umami*-enhancing composition may be in the form of an edible oil and fat composition. Specifically, e.g., an edible oil and fat, a diluent, an auxiliary agent, an emulsifier, a pH adjuster, etc., may be discretionarily blended as needed, and an edible oil and fat composition in the form of a liquid, a powder, a paste, or another discretionary form can be produced through a publicly known method. Specifically, for example, the edible oil and fat composition may be formulated, through use of a formulation technique well known to ordinary persons skilled in the art, as a liquid oil and fat, margarine, fat spread, shortening, powdered oil and fat, etc., that mainly contains oil and fat components, or in the form of a solution, a powder, a gel, granules, etc., in which the blended amount of oil and fat components is low; these forms can be employed in a discretionary manner. In addition, for example, when the edible oil and fat composition is powderized, corn syrup or another auxiliary agent can be used, and furthermore an emulsifier may be added to formulate an emulsification raw

material, which may then be powderized. Examples of means for powderization include spray-drying and freeze-drying. The oxidation treatment product formulated from the raw-material palm-based oil and fat composition in the manner described above, or the oil and fat composition containing said oxidation treatment product, may be used without modification in the one of forms as being the edible oil and fat composition.

[0031]

The *umami*-enhancing composition according to the present invention may be used in the form of an edible oil and fat composition as described above; in that instance, the amount of the oxidation treatment product of the palm-based oil and fat is preferably determined, as appropriate, from the standpoint of reaching a desired optimal amount during application, and there is no particular limitation as to this amount. However, this amount is preferably 1×10^{-5} mass% or more and 100 mass% or less, more preferably 1×10^{-4} mass% or more and 100 mass% or less, even more preferably 1×10^{-3} mass% or more and 100 mass% or less, and particularly preferably 1×10^{-2} mass% or more and 100 mass% or less.

[0032]

In a discretionary non-limiting mode of the present invention, there may be provided a seasoning or extract that contains the *umami*-enhancing composition. Specifically, for example, the *umami*-enhancing composition can be added, mixed,

dissolved, dispersed, emulsified, injected, etc., at a discretionary timing into a raw material for the seasoning or extract, an intermediate article of a manufacturing step, etc., whereby the *umami*-enhancing composition and an *umami* component that is a constituent element of the seasoning or extract are mixed to obtain the seasoning or extract.

[0033]

In another discretionary non-limiting mode of the present invention, there may be provided an oil and fat composition for cooking with heat that contains the *umami*-enhancing composition. Specifically, for example, the *umami*-enhancing composition can be mixed with an edible oil and fat to obtain the oil and fat composition for cooking with heat. The oil and fat composition for cooking with heat can be used to fry, stir-fry, or otherwise cook with heat an *umami* food such as: pork, chicken, beef, and other meats from livestock animals; fish, shellfish, and other seafood; and mushrooms, thereby yielding a heat-cooked food product in which *umami* is enhanced.

[0034]

There is no particular limitation as to the amount of the oxidation treatment product of the palm-based oil and fat contained in the oil and fat composition for cooking with heat; however, this amount is preferably 1 mass ppm or more and 100000 mass ppm or less, more preferably 10 mass ppm or more and 70000 mass ppm or less, even more preferably 100 mass

ppm or more and 40000 mass ppm or less, and particularly preferably 1000 mass ppm or more and 20000 mass ppm or less. Moreover, in terms of the amount of pre-degraded carotenoids, the amount of the oxidation treatment product of the palm-based oil and fat contained in the oil and fat composition for cooking with heat is preferably 1×10^{-3} mass ppm or more and 40 mass ppm or less, more preferably 1×10^{-2} mass ppm or more and 30 mass ppm or less, even more preferably 1×10^{-1} mass ppm or more and 20 mass ppm or less, and particularly preferably 1 mass ppm or more and 10 mass ppm or less.

[0035]

When the present invention is applied to a seasoning, an *umami* component is preferably contained in the seasoning, and there is no particular limitation as to the seasoning. Examples thereof include: monosodium glutamate, sodium inosinate, sodium guanylate, and mixtures of these; and soy sauce, miso, ketchup, and Worcester sauce.

[0036]

When the present invention is applied to a seasoning, the amount of the oxidation treatment product of the palm-based oil and fat contained in the seasoning is preferably determined, as appropriate, from the standpoint of reaching a desired optimal amount during application, and there is no particular limitation as to this amount. However, this amount is preferably 1×10^{-4} mass ppm or more and 1000 mass ppm or less, more preferably 1×10^{-3} mass ppm or more and 500 mass ppm

or less, even more preferably 1×10^{-2} mass ppm or more and 200 mass ppm or less, and particularly preferably 1×10^{-1} mass ppm or more and 100 mass ppm or less. Moreover, in terms of the amount of pre-degraded carotenoids, the amount is preferably 1×10^{-6} mass ppm or more and 1 mass ppm or less, more preferably 1×10^{-5} mass ppm or more and 1 mass ppm or less, even more preferably 1×10^{-4} mass ppm or more and 1 mass ppm or less, and particularly preferably 1×10^{-3} mass ppm or more and 1 mass ppm or less.

10 [0037]

When the present invention is applied to an extract, an *umami* component is preferably contained in the extract, and there is no particular limitation as to the extract. Examples thereof include: marine product extracts extracted from marine products such as bonito, mackerel, scallops, oysters, and *konbu*; meat extracts obtained by extraction from the meat, bones, carcass, etc., of livestock animals from which pork, chicken, beef, etc., are obtained; yeast extracts extracted from yeast; and vegetable extracts extracted from various vegetables (onion, garlic, cabbage, etc.).

[0038]

When the present invention is applied to an extract, the amount of the oxidation treatment product of the palm-based oil and fat contained in the seasoning is preferably determined, as appropriate, from the standpoint of reaching a desired optimal amount during application, and there is no

particular limitation as to this amount. However, this amount is preferably 1×10^{-4} mass ppm or more and 1000 mass ppm or less, more preferably 1×10^{-3} mass ppm or more and 500 mass ppm or less, even more preferably 1×10^{-2} mass ppm or more and 200 mass ppm or less, and particularly preferably 1×10^{-1} mass ppm or more and 100 mass ppm or less. Moreover, in terms of the amount of pre-degraded carotenoids, the amount is preferably 1×10^{-6} mass ppm or more and 1 mass ppm or less, more preferably 1×10^{-5} mass ppm or more and 1 mass ppm or less, even more preferably 1×10^{-4} mass ppm or more and 1 mass ppm or less, and particularly preferably 1×10^{-3} mass ppm or more and 1 mass ppm or less.

[0039]

In a discretionary non-limiting mode of the present invention, there may be provided a method for enhancing the *umami* of a food product by imparting the *umami*-enhancing composition to a food product. Specifically, for example, the *umami*-enhancing composition can be added, mixed, dissolved, dispersed, emulsified, injected, etc., at a discretionary timing into a raw material for a food product, an intermediate article of a manufacturing step, etc., whereby the *umami* of a food product presenting *umami* is enhanced. It is also possible to enhance the *umami* of a heat-cooked food product, obtained by frying, stir-frying, or otherwise cooking an *umami* food with heat, using the *umami*-enhancing composition in the form of an oil and fat composition for cooking with heat that is

obtained by addition of the *umami*-enhancing composition. There is no particular limitation as to the state in which the *umami*-enhancing composition is imparted to the food product; said composition may not only be added, etc., to a raw material or an intermediate article of a manufacturing step, but also may be imparted to a food product by sprinkling or coating after the food product is cooked, processed, manufactured, etc.

[0040]

When the present invention is applied to a food product, the amount of the oxidation treatment product of the palm-based oil and fat contained in the food product is preferably determined, as appropriate, from the standpoint of reaching a desired optimal amount during application, and there is no particular limitation as to this amount. However, the amount is preferably 1×10^{-6} mass ppm or more and 1000 mass ppm or less, more preferably 1×10^{-5} mass ppm or more and 800 mass ppm or less, even more preferably 1×10^{-3} mass ppm or more and 600 mass ppm or less, and particularly preferably 0.1 mass ppm or more and 500 mass ppm or less. Moreover, in terms of the amount of pre-degraded carotenoids, the amount of the oxidation treatment product of the palm-based oil and fat contained in the food product is preferably 1×10^{-10} mass ppm or more and 10 mass ppm or less, more preferably 1×10^{-9} mass ppm or more and mass 5 mass ppm or less, even more preferably 1×10^{-7} mass ppm or more and 3 mass ppm or less, and

particularly preferably 1×10^{-5} mass ppm or more and 1 mass ppm or less.

[0041]

In a discretionary non-limiting mode of the present invention, it is possible for an article formulated by adding the oxidation treatment product of the palm-based oil and fat and an article formulated in the same manner without adding the oxidation treatment product of the palm-based oil and fat to be submitted to a sensory evaluation test, preferably a sensory evaluation test carried out by a plurality of panel experts chosen from a population so as not to have a preferential tendency, to thereby conduct an objective evaluation as to whether the *umami* of the food product, seasoning, extract, oil and fat composition, etc., to which the present invention is applied has been enhanced.

[0042]

The food product, seasoning, extract, oil and fat composition, etc., to which the present invention can be applied is not limited in scope to use for humans, but rather can be applied also to pet food, fodder, etc., for animals.

[Examples]

[0043]

Examples are given below to more specifically describe the present invention, but these examples do not in any way limit the present invention.

[0044]

First, examples of the palm-based oil and fat used in the present example are given below, and methods for, *inter alia*, quantifying the α -carotene and the β -carotene are described.

[0045]

5 (1. Palm-based oil and fat)

- Red palm oil 1 (molecularly distilled, fractionated one time): total α -carotene and β -carotene content was 373 mass ppm, Carotino pure olein, manufactured by Carotino
- 10 • Red palm oil 2 (molecularly distilled, fractionated one time): total α -carotene and β -carotene content was 444 mass ppm, Carotino pure olein, manufactured by Carotino
- Red palm oil 3 (molecularly distilled, fractionated one time): total α -carotene and β -carotene content was 457 mass ppm, Carotino pure olein, manufactured by Carotino
- 15 • Red palm oil 4 (non-refined, subjected to low-temperature filtration): total α -carotene and β -carotene content was 341 mass ppm, EV redpalm oil, manufactured by Rainforest Herb
- 20 • Compounded red palm oil (molecularly distilled, fractionated one time): total α -carotene and β -carotene content was 115 mass ppm, obtained by
- 25 compounding red palm oil 1 and palm olein

(manufactured by J-Oil Mills Inc., proprietary
formulation) in ratio of 1:2 in terms of mass

[0046]

(2. Quantification of α -carotene and β -carotene)

5 The α -carotene and the β -carotene were quantified by
analysis through high-performance liquid chromatography (HPLC
analysis). Specifically, 0.5 g of the palm-based oil and fat
or the oxidation treatment product was measured out, each of
these components was diluted in a measuring flask using 10 mL
10 of acetone and tetrahydrofuran in a ratio of 1:1, the diluted
components were supplied for HPLC analysis, and the α -carotene
content and the β -carotene content were quantified from a
calibration curve. The calibration curve was created, using a
reagent (manufactured by Fujifilm Wako Pure Chemical Corp.) of
15 α -carotene (model no. 035-17981) and β -carotene (model no.
035-05531) as a quantification formulation, from the peak area
upon supply to HPLC analysis for each prescribed
concentration. The primary analysis conditions are indicated
below.

20 [0047]

(HPLC conditions)

- Detector: Photodiode array detector "2996 Photodiode
Array Detector" (Waters), detected at 300-600 nm
- Column: Shim-pack VP-ODS, 4.6 mmID×250 mm, 4.6 μ m
25 (Shimadzu Corp.)

- Column temperature: 50°C
- Injection amount: 5 µL
- Flow rate: 1.2 mL/min
- Mobile phase A: Acetonitrile
- Mobile phase B: Ethanol
- Mobile phase C: Acetone
- Gradient conditions: Refer to table 1

[0048]

[Table 1]

Gradient conditions			
Min	A (vol%)	B (vol%)	C (vol%)
0	80	20	0
22.0	80	20	0
22.1	0	0	100
25.0	0	0	100
25.1	80	20	0
30.0	80	20	0

[0049]

(3. Quantification of hexanal)

The hexanal content was quantified under the conditions described below using a gas chromatography mass spectrometer (GC/MS). The calibration curve was created using hexanal (manufactured by Fujifilm Wako Pure Chemical Corp.).

[0050]

(GC/MS conditions)

- Device: GC Agilent 7890A/MS 5975B (manufactured by Agilent Technologies, Inc.)

- Column: VF-WAXms, 60 m (length)×0.25 mm (inside diameter)× 0.25 µm (film thickness) (manufactured by Agilent Technologies, Inc.)
- Carrier gas: Helium
- 5 • Carrier flow rate: 1.2 mL/min
- Injection opening: temperature 240°C, splitless
- Oven: 40°C (five min) → 3°C/min → 190°C (five min) → 10°C/min → 240°C (30 min)
- Injection amount: 1 µL
- 10 • Ionization method: EI method (70 eV)
- Ion source: 250°C
- Quadrupole: 150°C
- Measurement mode: Scan
- Creation of calibration curve:
- 15 Hexanal (manufactured by Fujifilm Wako Pure Chemical Corp.) was diluted, as appropriate, using acetonitrile (manufactured by Fujifilm Wako Pure Chemical Corp.) to formulate hexanal solutions from 0.125 ug/mL to 100 ug/mL. 100 µL of a 110 ug/mL 2,6-dimethyl-5-heptenal (manufactured by Sigma Aldrich)/acetonitrile solution was added as an internal standard to 1 mL of the hexanal solution to formulate a calibration curve sample. The calibration curve sample was transferred to a vial and supplied for GC/MS analysis. The calibration curve was created from the area ratio of the
- 25 hexanal and the internal standard.

- Quantification of hexanal concentration:

0.5 g of the palm-based oil and fat or the oxidation treatment product was measured out, and 100 μ L of a 110 ug/mL 2,6-dimethyl-5-heptenal/acetonitrile solution was added as an internal standard. 1 mL of acetonitrile was subsequently added and vortexing was carried out for 20 minutes. The resultant solution was then subjected to centrifugal separation for five minutes at 3000 rpm using a centrifuge (Kubota Corp.). A supernatant acetonitrile phase was transferred to a vial and supplied for GC/MS analysis. The area ratio of the hexanal and the internal standard was calculated, and the hexanal concentration was calculated from a comparison with the calibration curve.

[0051]

[Measurement of peroxide value (POV)]

The POV was measured in conformance with "Standard methods for the analysis of fats, oils and related materials: 2.5.2 Peroxide value" (Japan Oil Chemists' Society).

[0052]

(4. Formulation of oxidation treatment product of oil and fat)

The various oils and fats shown in table 2 were used to formulate oxidation treatment products thereof. Specifically, red palm oils containing α -carotene and β -carotene in prescribed amounts (mass ppm) were prepared, and the red palm oils were heat treated under the heat treatment conditions

indicated in table 2 while being stirred, to obtain the oxidation treatment products in examples 1 to 6. During heat treatment, the treatment was carried out while air was blown in at a prescribed amount (0.01 L/min or 0.2 L/min). One raw-
5 material red palm oil not subjected to heat treatment was employed as comparative example 1 as a control. A substance obtained by implementing heat treatment on rapeseed oil under the same conditions as in example 5 was employed as comparative example 2.

10 [0053]

Table 2 shows the oil and fat used, the total α -carotene and β -carotene content of the oil and fat (carotene content), the heat treatment conditions, the total amount of α -carotene and β -carotene remaining after heat treatment (carotene
15 remaining amount), the values of the peroxide value (POV) measured before and after heat treatment, and the hexanal concentration in the oil and fat after heat treatment.

[0054]

[Table 2]

	Palm-based oil and fat or rapeseed oil used	Carotene content* (mass ppm)	Heat treatment conditions		Carotene remaining amount** (mass ppm)	POV		Hexanal*** (mass ppm)
			Temperature and time	Air blowing amount		Before heating	After heating	
Comparative example 1	Red palm oil (molecularly distilled, fractionated one time)	373	—	—	373	1	—	0.6
Example 1	Red palm oil (molecularly distilled, fractionated one time)	444	80°C (182 hr)	0.2 L/min	0	1	80	35.8
Example 2	Red palm oil (molecularly distilled, fractionated one time)	457	103°C (53 hr)	0.01 L/min	0	1	115	64.9
Example 3	Red palm oil (molecularly distilled, fractionated one time)	373	120°C (2 hr)	0.2 L/min	265	1	8	0.4

	Palm-based oil and fat or rapeseed oil used	Carotene content* (mass ppm)	Heat treatment conditions		Carotene remaining amount** (mass ppm)	POV		Hexanal*** (mass ppm)
			Temperature and time	Air blowing amount		Before heating	After heating	
Example 4	Compounded red palm oil (molecularly distilled, fractionated one time)	115	103°C (64 hr)	0.2 L/min	0	1	216	303.8
Example 5	Red palm oil (Non-refined, subjected to low-temperature filtration)	341	120°C (5 hr) → 80°C (5 hr)	0.2 L/min	198	1	17	30.7
Example 6	Red palm oil (molecularly distilled, fractionated one time)	373	103°C (40 hr)	0.2 L/min	2	1	56	33.1
Comparative example 2	Rapeseed oil	0	120°C (5 hr) → 80°C (5 hr)	0.2 L/min	0	0	49	4

Carotene content*: Total α -carotene and β -carotene content
Carotene remaining amount**: Total of α -carotene and β -carotene remaining amount
Hexanal***: Hexanal concentration of oil and fat after heat treatment

[0055]

As shown in table 2, the amount of α -carotene and β -carotene contained in the red palm oil decreased due to the heat treatment; in the present formulation conditions, the α -carotene and β -carotene in the red palm oil was degraded to a greater extent by carrying out heating for a longer time or by raising the temperature. The value of the peroxide value (POV) increased due to the heat treatment. Hexanal was detected as one oxidation treatment product in the oil and fat after the heat treatment.

[0056]

[Test example 1] (Monosodium glutamate, part 1)

1 g of monosodium glutamate was dissolved in 499 g of water to formulate an *umami* aqueous solution A containing 0.2 mass% of monosodium glutamate.

[0057]

Sensory evaluation of the *umami* of the red palm oil in comparative example 1, or of the oxidation treatment products of the oils and fats in examples 1 to 6 and comparative example 2, was conducted using the *umami* aqueous solution A. Specifically, once the components were diluted with rapeseed oil, as appropriate, so as to reach the blending ratios in the upper section of table 3, the diluted components were added to the *umami* aqueous solution A, 2 mL of the resultant samples was retrieved, and the strength of the *umami* upon drinking of the samples was scored through evaluation relative to

comparative example 1 according to the following criteria, to
derive a median value and a mean value for the samples. The
sensory evaluation was conducted by three panel experts. A "6"
under the following criteria corresponds to the *umami* of a 0.4
5 mass% aqueous solution of monosodium glutamate.

[0058]

(Criteria)

	6	Extremely strong
	5	Considerably strong
10	4	Strong
	3	Comparatively strong
	2	Somewhat strong
	1	Barely strong
	0	Equivalent
15	-1	Barely weak
	-2	Somewhat weak
	-3	Comparatively weak
	-4	Weak
	-5	Considerably weak
20	-6	Extremely weak

[0059]

The results of the sensory evaluation are collectively
shown in the lower section of table 3.

[0060]

[Table 3]

(Monosodium glutamate, part 1)

	Formu- lation example 1-1	Formu- lation example 1-2	Formu- lation example 1-3	Formu- lation example 1-4	Formu- lation example 1-5	Formu- lation example 1-6	Formu- lation example 1-7	Formu- lation example 1-8	Formu- lation example 1-9	Formu- lation example 1-10
Oil and fat (g)	Rapeseed oil	0.2475	0.2475	0.2475	0.2475	0.2475	0.2475	0.2475	0.249925	0.24975
	Comparative example 1	0.0025								
	Example 1		0.0025							
	Example 2									
	Example 3			0.0025						
	Example 4				0.0025					
	Example 5					0.0025				
	Example 6						0.0025			
	Comparative example 2							0.0025		
Hexanal (g)									0.000075	0.00025
Umami aqueous solution A (g)	49.75	49.75	49.75	49.75	49.75	49.75	49.75	49.75	49.75	49.75
Oil fraction (mass%)	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Heat-treated oil and fat concentration (mass ppm)	—	50	50	50	50	50	50	50	—	—
Total mass (g)	50	50	50	50	50	50	50	50	50	50

	Formu- lation example 1-1	Formu- lation example 1-2	Formu- lation example 1-3	Formu- lation example 1-4	Formu- lation example 1-5	Formu- lation example 1-6	Formu- lation example 1-7	Formu- lation example 1-8	Formu- lation example 1-9	Formu- lation example 1-10
Heat-treated carotene* content (mass ppm)	—	0.0222	0.0229	0.0054	0.0058	0.0072	0.0186	0	—	—
Hexanal content (mass ppm)	0.00003	0.00179	0.00324	0.00002	0.01519	0.00153	0.00165	0.00020	1.5**	5.0**
Strength of <i>umami</i>	Expert 1	0	3	4	5	4	5	5	1	0
	Expert 2	0	2	3	4	3	3	4	1	1
	Expert 3	0	3	3	4	3	5	5	0	1
Median value		0	3	3	4	3	5	5	1	0
Mean value		0	3	3	4	3	5	5	1	0

Heat-treated carotene*: Amount in terms of total α -carotene and β -carotene content prior to heat treatment

Hexanal content**: Amount calculated from added amount

[0061]

According to these results, an effect for enhancing the *umami* of the *umami* aqueous solution was obtained such that the *umami* was stronger in formulation examples 1-2 to 1-7, which
5 involved the use of an oxidation treatment product (examples 1 to 6) formulated by implementing heat treatment to a certain degree on red palm oil, than in formulation example 1-1, which involved the use of comparative example 1 formed from red palm oil not subjected to heat treatment. However, in formulation
10 example 1-8, which involved the use of comparative example 2 formulated by implementing a heat treatment on rapeseed oil, and in formulations examples 1-9 and 1-10, which involved the use of hexanol, which is one oxidation treatment product, substantially no effect for enhancing the *umami* of the *umami*
15 aqueous solution was obtained.

[0062]

As described above, it has been clarified that oxidation treatment products of red palm oil exhibit an effect for enhancing the *umami* of an *umami* aqueous solution. In addition,
20 because the same effect was not obtained using rapeseed oil that did not contain carotenes, it has been suggested that oxidation treatment products of carotenes contained in red palm oil contribute to enhancement of *umami*.

[0063]

25 [Test example 2] (Monosodium glutamate, part 2)

An effect for enhancing *umami* was evaluated using the

same method as in test example 1, except that the red palm oil in comparative example 1, and the oxidation treatment products of the oils and fats in examples 3 and 6 and comparative example 2, were added to an *umami* aqueous solution using the
5 blends indicated in the upper section of table 4.

[0064]

The results of the sensory evaluation are collectively shown in the lower section of table 4.

[0065]

10 [Table 4]

(Monosodium glutamate, part 2)

		Formulation example 2-1	Formulation example 2-2	Formulation example 2-3	Formulation example 2-4
Oil and fat (g)	Rapeseed oil	0.24975	0.24975	0.24975	0.24975
	Comparative example 1	0.00025			
	Example 3		0.00025		
	Example 6			0.00025	
	Comparative example 2				0.00025
Umami aqueous solution A (g)		49.75	49.75	49.75	49.75
Oil fraction (mass%)		0.5	0.5	0.5	0.5
Heat-treated oil and fat concentration (mass ppm)		—	5	5	5
Total mass (g)		50	50	50	50
Heat-treated carotene* content (mass ppm)		—	0.00054	0.00186	0
Strength of <i>umami</i>	Expert 1	0	2	2	1
	Expert 2	0	2	2	1
	Expert 3	0	3	4	1
Median value		0	2	2	1
Mean value		0	2	3	1

Heat-treated carotene*: Amount in terms of total α -carotene and β -carotene content prior to heat treatment

5 [0066]

These results have clarified that the effect for enhancing the *umami* of the *umami* aqueous solution is obtained due to the oxidation treatment product of the red palm oil when the heat-treated carotene content (amount in terms of amount prior to heat treatment) is within the range of 0.00054 mass ppm or more.

[0067]

[Test example 3] (*Umami* seasoning)

1 g of a commercially available *umami* seasoning ("Ajinomoto"®, Ajinomoto Co., Inc.) was dissolved in 499 g of water to formulate an *umami* aqueous solution B containing 0.2 mass% of the *umami* seasoning.

[0068]

An effect for enhancing *umami* was evaluated using the same method as in test example 1, except that: the *umami* aqueous solution B was used, and the red palm oil in comparative example 1, and the oxidation treatment products of the oils and fats in examples 1 to 6 and comparative example 2, were added to the *umami* aqueous solution using the blends indicated in the upper section of table 5; and the sensory evaluation was conducted by five panel experts.

[0069]

The results of the sensory evaluation are collectively shown in the lower section of table 5.

[0070]

[Table 5]

(Umami seasoning)

	Formulation example 3-1	Formulation example 3-2	Formulation example 3-3	Formulation example 3-4	Formulation example 3-5	Formulation example 3-6	Formulation example 3-7	Formulation example 3-8
Oil and fat (g)	Rapeseed oil	0.2475	0.2475	0.2475	0.2475	0.2475	0.2475	0.2475
	Comparative example 1	0.0025						
	Example 1		0.0025					
	Example 2							
	Example 3			0.0025				
	Example 4				0.0025			
	Example 5					0.0025		
	Example 6						0.0025	
	Comparative example 2							0.0025
Umami aqueous solution B (g)	49.75	49.75	49.75	49.75	49.75	49.75	49.75	49.75
Oil fraction (mass%)	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Heat-treated oil and fat concentration (mass ppm)	—	50	50	50	50	50	50	50
Total mass (g)	50	50	50	50	50	50	50	50
Heat-treated carotene* content (mass ppm)	—	0.0222	0.0229	0.0054	0.0058	0.0072	0.0186	0

	Formulation example 3-1	Formulation example 3-2	Formulation example 3-3	Formulation example 3-4	Formulation example 3-5	Formulation example 3-6	Formulation example 3-7	Formulation example 3-8
Strength of <i>umami</i>	Expert 1	0	4	5	6	5	5	0
	Expert 2	0	3	3	3	4	4	1
	Expert 3	0	3	4	5	2	4	1
	Expert 4	0	3	4	4	4	4	2
	Expert 5	0	2	4	0	2	2	0
Median value	0	3	4	4	4	4	4	1
Mean value	0	3	4	4	4	3	4	1

Heat-treated carotene*: Amount in terms of total α -carotene and β -carotene content prior to heat treatment

[0071]

These results have clarified that the effect for enhancing the *umami* of the *umami* aqueous solution is obtained due to the oxidation treatment product of the red palm oil even in a 0.2 mass% *umami* aqueous solution formulated using a commercially available *umami* seasoning.

[0072]

[Test example 4] (Nucleic-acid-based *umami* component)

1 g of sodium 5'-ribonucleotide (mixture of disodium 5'-inosinate and disodium 5'-guanylate) (trade name: Ribotide, Mitsubishi Corporation Life Sciences Ltd.), which is a nucleic-acid-based *umami* component, was dissolved in 499 g of water to formulate an *umami* aqueous solution C containing 0.2 mass% of the nucleic-acid-based *umami* component.

[0073]

An effect for enhancing *umami* was evaluated using the same method as in test example 1, except that the *umami* aqueous solution C was used, and the red palm oil in comparative example 1, and the oxidation treatment products of the oils and fats in examples 3 and 6 and comparative example 2, were added to the *umami* aqueous solution using the blends indicated in the upper section of table 6.

[0074]

The results of the sensory evaluation are collectively shown in the lower section of table 6.

[0075]

[Table 6]

(Nucleic-acid-based *umami* component)

		Formulation example 4-1	Formulation example 4-2	Formulation example 4-3	Formulation example 4-4
Oil and fat (g)	Rapeseed oil	0.2475	0.2475	0.2475	0.2475
	Comparative example 1	0.0025			
	Example 3		0.0025		
	Example 6			0.0025	
	Comparative example 2				0.0025
<i>Umami</i> aqueous solution C (g)		49.75	49.75	49.75	49.75
Oil fraction (mass%)		0.5	0.5	0.5	0.5
Heat-treated oil and fat concentration (mass ppm)		—	50	50	50
Total mass (g)		50	50	50	50
Heat-treated carotene* content (mass ppm)		—	0.0054	0.0186	0
Strength of <i>umami</i>	Expert 1	0	3	3	0
	Expert 2	0	2	3	0
	Expert 3	0	3	2	1
Median value		0	3	3	0
Mean value		0	3	3	0

Heat-treated carotene*: Amount in terms of total α -carotene and β -carotene content prior to heat treatment

5

[0076]

These results have clarified that the effect for enhancing the *umami* of the *umami* aqueous solution is obtained due to the oxidation treatment product of the red palm oil even in a 0.2 mass% *umami* aqueous solution formulated using a

10

[0077]

[Test example 5] (Chicken stock)

4.17 g of a commercially available powdered chicken stock (trade name "Maru chicken stock," Ajinomoto Co., Ltd.) was dissolved in 495.83 g of water to formulate an *umami* aqueous solution D containing 0.83 mass% of the powdered chicken stock.

[0078]

An effect for enhancing *umami* was evaluated using the same method as in test example 1, except that the *umami* aqueous solution D was used, and the red palm oil in comparative example 1, and the oxidation treatment products of the oils and fats in examples 3 and 6 and comparative example 2, were added to the *umami* aqueous solution using the blends indicated in the upper section of table 7.

[0079]

The results of the sensory evaluation are collectively shown in the lower section of table 7.

[0080]

[Table 7]

(Chicken stock)

		Formulation example 5-1	Formulation example 5-2	Formulation example 5-3	Formulation example 5-4
Oil and fat (g)	Rapeseed oil	0.2475	0.2475	0.2475	0.2475
	Comparative example 1	0.0025			
	Example 3		0.0025		
	Example 6			0.0025	
	Comparative example 2				0.0025
Umami aqueous solution D (g)		49.75	49.75	49.75	49.75
Oil fraction (mass%)		0.5	0.5	0.5	0.5
Heat-treated oil and fat concentration (mass ppm)		—	50	50	50
Total mass (g)		50	50	50	50
Heat-treated carotene* content (mass ppm)		—	0.0054	0.0186	0
Strength of <i>umami</i>	Expert 1	0	2	3	1
	Expert 2	0	4	3	0
	Expert 3	0	3	3	0
Median value		0	3	3	0
Mean value		0	3	3	0

Heat-treated carotene*: Amount in terms of total α -carotene and β -carotene content prior to heat treatment

5 [0081]

These results have clarified that the effect for enhancing the *umami* of the *umami* aqueous solution is obtained due to the oxidation treatment product of the red palm oil even in a 0.83 mass% *umami* aqueous solution formulated using commercially available powdered chicken stock.

[0082]

[Test example 6] (Powdered bonito stock)

3.33 g of a commercially available powdered bonito stock ("Hondashi"®, Ajinomoto Co., Ltd.) was dissolved in 496.67 g of water to formulate an *umami* aqueous solution E containing 0.67 mass% of the powdered bonito stock.

5 [0083]

An effect for enhancing *umami* was evaluated using the same method as in test example 1, except that the *umami* aqueous solution E was used, and the red palm oil in comparative example 1, and the oxidation treatment products of
10 the oils and fats in examples 3 and 6 and comparative example 2, were added to the *umami* aqueous solution using the blends indicated in the upper section of table 8.

[0084]

The results of the sensory evaluation are collectively
15 shown in the lower section of table 8.

[0085]

[Table 8]

(Powdered bonito stock)

		Formulation example 6-1	Formulation example 6-2	Formulation example 6-3	Formulation example 6-4
Oil and fat (g)	Rapeseed oil	0.2475	0.2475	0.2475	0.2475
	Comparative example 1	0.0025			
	Example 3		0.0025		
	Example 6			0.0025	
	Comparative example 2				0.0025
Umami aqueous solution E (g)		49.75	49.75	49.75	49.75
Oil fraction (mass%)		0.5	0.5	0.5	0.5
Heat-treated oil and fat concentration (mass ppm)		—	50	50	50
Total mass (g)		50	50	50	50
Heat-treated carotene* content (mass ppm)		—	0.0054	0.0186	0
Strength of <i>umami</i>	Expert 1	0	1	2	0
	Expert 2	0	4	3	1
	Expert 3	0	3	4	0
Median value		0	3	3	0
Mean value		0	3	3	0

Heat-treated carotene*: Amount in terms of total α -carotene and β -carotene content prior to heat treatment

5 [0086]

These results have clarified that the effect for enhancing the *umami* of the *umami* aqueous solution is obtained due to the oxidation treatment product of the red palm oil even in a 0.67 mass% *umami* aqueous solution formulated using commercially available powdered bonito stock.

[0087]

[Test example 7] (Powdered *konbu* stock)

3.33 g of a commercially available powdered *konbu* stock ("Hondashi"® *konbu* stock, Ajinomoto Co., Ltd.) was dissolved in 496.67 g of water to formulate an *umami* aqueous solution F containing 0.67 mass% of the powdered *konbu* stock.

5 [0088]

An effect for enhancing *umami* was evaluated using the same method as in test example 1, except that the *umami* aqueous solution F was used, and the red palm oil in comparative example 1, and the oxidation treatment products of the oils and fats in examples 3 and 6 and comparative example 2, were added to the *umami* aqueous solution using the blends indicated in the upper section of table 9.

[0089]

The results of the sensory evaluation are collectively shown in the lower section of table 9.

[0090]

[Table 9]

(Powdered *konbu* stock)

		Formulation example 7-1	Formulation example 7-2	Formulation example 7-3	Formulation example 7-4
Oil and fat (g)	Rapeseed oil	0.2475	0.2475	0.2475	0.2475
	Comparative example 1	0.0025			
	Example 3		0.0025		
	Example 6			0.0025	
	Comparative example 2				0.0025
Umami aqueous solution F (g)		49.75	49.75	49.75	49.75
Oil fraction (mass%)		0.5	0.5	0.5	0.5
Heat-treated oil and fat concentration (mass ppm)		—	50	50	50
Total mass (g)		50	50	50	50
Heat-treated carotene* content (mass ppm)		—	0.0054	0.0186	0
Strength of <i>umami</i>	Expert 1	0	2	2	0
	Expert 2	0	2	1	0
	Expert 3	0	2	3	-1
Median value		0	2	2	0
Mean value		0	2	2	0

Heat-treated carotene*: Amount in terms of total α -carotene and β -carotene content prior to heat treatment

5 [0091]

These results have clarified that the effect for enhancing the *umami* of the *umami* aqueous solution is obtained due to the oxidation treatment product of the red palm oil even in a 0.67 mass% *umami* aqueous solution formulated using commercially available powdered *konbu* stock.

[0092]

[Test example 8] (Consommé)

4.17 g of solid consommé (trade name "Ajinomoto KK consommé," Ajinomoto Co., Ltd.) was dissolved in 495.83 g of water to formulate an *umami* aqueous solution G containing 0.83 mass% of the solid consommé.

5 [0093]

An effect for enhancing *umami* was evaluated using the same method as in test example 1, except that the *umami* aqueous solution G was used, and the red palm oil in comparative example 1, and the oxidation treatment products of the oils and fats in examples 3 and 6 and comparative example 2, were added to the *umami* aqueous solution using the blends indicated in the upper section of table 10.

[0094]

The results of the sensory evaluation are collectively shown in the lower section of table 10.

[0095]

[Table 10]

(Consommé)

		Formulation example 8-1	Formulation example 8-2	Formulation example 8-3	Formulation example 8-4
Oil and fat (g)	Rapeseed oil	0.2475	0.2475	0.2475	0.2475
	Comparative example 1	0.0025			
	Example 3		0.0025		
	Example 6			0.0025	
	Comparative example 2				0.0025
Umami aqueous solution G (g)		49.75	49.75	49.75	49.75
Oil fraction (mass%)		0.5	0.5	0.5	0.5
Heat-treated oil and fat concentration (mass ppm)		—	50	50	50
Total mass (g)		50	50	50	50
Heat-treated carotene* content (mass ppm)		—	0.0054	0.0186	0
Strength of <i>umami</i>	Expert 1	0	4	5	2
	Expert 2	0	2	3	0
	Expert 3	0	1	1	0
Median value		0	2	3	0
Mean value		0	2	3	1

Heat-treated carotene*: Amount in terms of total α -carotene and β -carotene content prior to heat treatment.

5 [0096]

These results have clarified that the effect for enhancing the *umami* of the *umami* aqueous solution is obtained due to the oxidation treatment product of the red palm oil even in a 0.83 mass% *umami* aqueous solution formulated using solid consommé.

[0097]

[Test example 9] (Pork extract)

6 g of a pork extract (product name: Pork stock 50-10-N, DSP Gokyo Food & Chemical Co., Ltd.) was dissolved in 494 g of water to formulate an *umami* aqueous solution H containing 1.2 mass% of the pork extract.

5 [0098]

An effect for enhancing *umami* was evaluated using the same method as in test example 1, except that the *umami* aqueous solution H was used, and the red palm oil in comparative example 1, and the oxidation treatment products of the oils and fats in examples 3 and 6 and comparative example 2, were added to the *umami* aqueous solution using the blends indicated in the upper section of table 11.

[0099]

The results of the sensory evaluation are collectively shown in the lower section of table 11.

[0100]

[Table 11]

(Pork extract)

		Formulation example 9-1	Formulation example 9-2	Formulation example 9-3	Formulation example 9-4
Oil and fat (g)	Rapeseed oil	0.2475	0.2475	0.2475	0.2475
	Comparative example 1	0.0025			
	Example 3		0.0025		
	Example 6			0.0025	
	Comparative example 2				0.0025
Umami aqueous solution H (g)		49.75	49.75	49.75	49.75
Oil fraction (mass%)		0.5	0.5	0.5	0.5
Heat-treated oil and fat concentration (mass ppm)		—	50	50	50
Total mass (g)		50	50	50	50
Heat-treated carotene* content (mass ppm)		—	0.0054	0.0186	0
Strength of <i>umami</i>	Expert 1	0	3	3	1
	Expert 2	0	1	1	0
	Expert 3	0	3	2	0
Median value		0	3	2	0
Mean value		0	2	2	0

Heat-treated carotene*: Amount in terms of total α -carotene and β -carotene content prior to heat treatment

5 [0101]

These results have clarified that the effect for enhancing the *umami* of the *umami* aqueous solution is obtained due to the oxidation treatment product of the red palm oil even in a 1.2 mass% *umami* aqueous solution formulated using a

10 pork extract.

[0102]

[Test example 10] (Beef extract)

6 g of a beef extract (product name: Adipol beef UP, DSP Gokyo Food & Chemical Co., Ltd.) was dissolved in 494 g of water to formulate an *umami* aqueous solution I containing 1.2 mass% of the beef extract.

5 [0103]

An effect for enhancing *umami* was evaluated using the same method as in test example 1, except that the *umami* aqueous solution I was used, and the red palm oil in comparative example 1, and the oxidation treatment products of the oils and fats in examples 3 and 6 and comparative example 2, were added to the *umami* aqueous solution using the blends indicated in the upper section of table 12.

[0104]

The results of the sensory evaluation are collectively shown in the lower section of table 12.

[0105]

[Table 12]

(Beef extract)

		Formulation example 10- 1	Formulation example 10- 2	Formulation example 10- 3	Formulation example 10- 4
Oil and fat (g)	Rapeseed oil	0.2475	0.2475	0.2475	0.2475
	Comparative example 1	0.0025			
	Example 3		0.0025		
	Example 6			0.0025	
	Comparative example 2				0.0025
Umami aqueous solution I (g)		49.75	49.75	49.75	49.75
Oil fraction (mass%)		0.5	0.5	0.5	0.5
Heat-treated oil and fat concentration (mass ppm)		—	50	50	50
Total mass (g)		50	50	50	50
Heat-treated carotene* content (mass ppm)		—	0.0054	0.0186	0
Strength of <i>umami</i>	Expert 1	0	5	6	2
	Expert 2	0	3	4	1
	Expert 3	0	4	3	3
Median value		0	4	4	2
Mean value		0	4	4	2

Heat-treated carotene*: Amount in terms of total α -carotene and β -carotene content prior to heat treatment

5 [0106]

These results have clarified that the effect for enhancing the *umami* of the *umami* aqueous solution is obtained due to the oxidation treatment product of the red palm oil even in a 1.2 mass% *umami* aqueous solution formulated using a

10 beef extract.

[0107]

[Test example 11] (Yeast extract)

6 g of a yeast extract (product name: Aromild, DSP Gokyo Food & Chemical Co., Ltd.) was dissolved in 494 g of water to formulate an *umami* aqueous solution J containing 1.2 mass% of the yeast extract.

5 [0108]

An effect for enhancing *umami* was evaluated using the same method as in test example 1, except that the *umami* aqueous solution J was used, and the red palm oil in comparative example 1, and the oxidation treatment products of the oils and fats in examples 3 and 6 and comparative example 2, were added to the *umami* aqueous solution using the blends indicated in the upper section of table 13.

[0109]

The results of the sensory evaluation are collectively shown in the lower section of table 13.

[0110]

[Table 13]

(Yeast extract)

		Formulation example 11- 1	Formulation example 11- 2	Formulation example 11- 3	Formulation example 11- 4
Oil and fat (g)	Rapeseed oil	0.2475	0.2475	0.2475	0.2475
	Comparative example 1	0.0025			
	Example 3		0.0025		
	Example 6			0.0025	
	Comparative example 2				0.0025
Umami aqueous solution J (g)		49.75	49.75	49.75	49.75
Oil fraction (mass%)		0.5	0.5	0.5	0.5
Heat-treated oil and fat concentration (mass ppm)		—	50	50	50
Total mass (g)		50	50	50	50
Heat-treated carotene* content (mass ppm)		—	0.0054	0.0186	0
Strength of <i>umami</i>	Expert 1	0	1	2	0
	Expert 2	0	2	2	0
	Expert 3	0	2	2	0
Median value		0	2	2	0
Mean value		0	2	2	0

Heat-treated carotene*: Amount in terms of total α -carotene and β -carotene content prior to heat treatment

5 [0111]

These results have clarified that the effect for enhancing the *umami* of the *umami* aqueous solution is obtained due to the oxidation treatment product of the red palm oil even in a 1.2 mass% *umami* aqueous solution formulated using a yeast extract.

[0112]

[Test example 12] (*Konbu* stock, part 1)

20 g of *konbu* was introduced into 1000 g of water, the mixture was heated over medium heat until just before boiling, and then the *konbu* was removed to formulate a *konbu* stock.

[0113]

5 An effect for enhancing *umami* was evaluated using the same method as in test example 1, except that the *konbu* stock was used as an *umami* aqueous solution K, and the red palm oil in comparative example 1, and the oxidation treatment products of the oils and fats in examples 3 and 6 and comparative
10 example 2, were added to the *umami* aqueous solution using the blends indicated in the upper section of table 14.

[0114]

The results of the sensory evaluation are collectively shown in the lower section of table 14.

15 [0115]

[Table 14]

(Konbu stock, part 1)

		Formulation example 12- 1	Formulation example 12- 2	Formulation example 12- 3	Formulation example 12- 4
Oil and fat (g)	Rapeseed oil	0.2475	0.2475	0.2475	0.2475
	Comparative example 1	0.0025			
	Example 3		0.0025		
	Example 6			0.0025	
	Comparative example 2				0.0025
Umami aqueous solution K (g)		49.75	49.75	49.75	49.75
Oil fraction (mass%)		0.5	0.5	0.5	0.5
Heat-treated oil and fat concentration (mass ppm)		—	50	50	50
Total mass (g)		50	50	50	50
Heat-treated carotene* content (mass ppm)		—	0.0054	0.0186	0
Strength of <i>umami</i>	Expert 1	0	1	2	0
	Expert 2	0	2	2	1
	Expert 3	0	3	4	0
Median value		0	2	2	0
Mean value		0	2	3	0

Heat-treated carotene*: Amount in terms of total α -carotene and β -carotene content prior to heat treatment

5 [0116]

These results have clarified that the effect for enhancing the *umami* of the *umami* aqueous solution is obtained due to the oxidation treatment product of the red palm oil even in an *umami* aqueous solution formed from *konbu* stock.

10 [0117]

[Test example 13] (*Konbu* stock, part 2)

<Formulation of powdered oil and fat>

A powdered oil and fat in which there was incorporated 1 mass% of the oxidation treatment product in example 6 formulated in test example 1 was formulated using the blend shown in table 15 (example 7). The powdered oil and fat was formulated in conformance with the disclosures in Japanese Unexamined Patent Publication No. 2017-63784 (paragraph [0046]). In addition, a powdered oil and fat serving as a control was formulated using the same method, except that no oxidation treatment product was blended therein (comparative example 3).

[0118]

[Table 15]

Raw material		Comparative example 3 (parts by mass)	Example 7 (parts by mass)
Oil phase	Ultrahardened palm kernel oil	45	44
	Oxidation treatment product of oil and fat in example 6	—	1
	Emulsifier	0.9	0.9
Aqueous phase	Corn syrup	47.5	47.5
	Acid casein	4.399	4.399
	Sodium hydroxide	0.101	0.101
	pH adjuster	2.1	2.1
Total		100	100
Oil and fat content of powdered oil and fat		45 mass%	45 mass%
Oxidation treatment product content of powdered oil and fat		—	1 mass%

[0119]

An effect for enhancing *umami* was evaluated using the same method as in test example 12, except that: the powdered

oil and fat in comparative example 3, and the powdered oil and fat in example 7, were added to the *umami* aqueous solution using the blends indicated in the upper section of table 16; and the evaluation was carried out through comparison relative to comparative example 3 rather than to comparative example 1.

[0120]

The results of the sensory evaluation are collectively shown in the lower section of table 16.

[0121]

10 [Table 16]

(*Konbu* stock, part 2)

		Formulation example 13-1	Formulation example 13-2
Powdered oil and fat (g)	Comparative example 3	0.5	
	Example 7		0.5
<i>Umami</i> aqueous solution K (g)		49.5	49.5
Oil fraction (mass%)		0.45	0.45
Heat-treated oil and fat concentration (mass ppm)		—	50
Total mass (g)		50	50
Heat-treated carotene* content (mass ppm)		—	0.0186
Strength of <i>umami</i>	Expert 1	0	2
	Expert 2	0	2
	Expert 3	0	3
Median		0	2
Mean		0	2

Heat-treated carotene*: Amount in terms of total α -carotene and β -carotene content prior to heat treatment

15 [0122]

These results have clarified that the effect for

enhancing the *umami* of the *umami* aqueous solution is obtained due to the oxidation treatment product of the red palm oil in an *umami* aqueous solution formed from *konbu* stock, even when the oxidation treatment product of the red palm oil is

5 formulated as a powdered oil and fat.

[0123]

[Test example 14] (*Tatsuta-age*)

An effect for enhancing *umami* when cooking *tatsuta-age* was examined using an oil and fat composition for cooking with
10 heat in which the oxidation treatment product of the red palm oil was blended.

[0124]

<Formulation of oil and fat composition for cooking with heat>

15 The oxidation treatment product of the oil and fat in example 6 was mixed with canola oil for frying (J-canola oil, manufactured by J-Oil Mills, Inc.) using the blend indicated in the upper section of table 17 to formulate an oil and fat composition for cooking with heat.

20 [0125]

(Formulation and evaluation of *tatsuta-age*)

(1) Pure-rice cooking sake (Toashuzo Co., Ltd.) and soy sauce were mixed in a ratio of 2:1 (mass ratio) to formulate a liquid seasoning.

25 (2) 30 parts by mass of the liquid seasoning was introduced into a plastic bag, a further 100 parts by mass of

chicken thigh that was cut to about 30 g was introduced therein, and the chicken thigh was immersed for 20 minutes.

(3) The chicken thigh was removed from the plastic bag and excess liquid was drained, after which the chicken thigh
5 was coated with potato starch.

(4) The chicken thigh coated with the potato starch was fried for six minutes using the oil and fat composition for cooking with heat, which had been heated to 180°C, to obtain *tatsuta-age*.

10 [0126]

The resultant *tatsuta-age* was eaten to conduct a sensory evaluation of *umami*. Specifically, scoring was carried out through evaluation relative to formulation example 14-1, which did not contain the oxidation treatment product of the red
15 palm oil, according to the following criteria, to derive a median value and a mean value for the samples. The sensory evaluation was conducted by six panel experts.

[0127]

(Criteria)

20	6	Extremely strong
	5	Considerably strong
	4	Strong
	3	Comparatively strong
	2	Somewhat strong
25	1	Barely strong
	0	Equivalent

- 1 Barely weak
- 2 Somewhat weak
- 3 Comparatively weak
- 4 Weak
- 5 Considerably weak
- 6 Extremely weak

[0128]

The results of the sensory evaluation are collectively shown in the lower section of table 17.

[0129]

[Table 17]

(Tatsuta-age)

		Formulation example 14-1	Formulation example 14-2	Formulation example 14-3
Oil and fat (g)	Rapeseed oil for frying	600	597	594
	Example 6		3	6
Heat-treated oil and fat concentration (mass ppm)		—	5000	10000
Total mass (g)		600	600	600
Heat-treated carotene* content (mass ppm)		—	1.86	3.71
Strength of <i>umami</i>	Expert 1	0	2	4
	Expert 2	0	1	1
	Expert 3	0	1	3
	Expert 4	0	0	2
	Expert 5	0	2	2
	Expert 6	0	0	2
Median value		0	1	2
Mean value		0	1	2

Heat-treated carotene*: Amount in terms of total α -carotene and β -carotene content prior to heat treatment

[0130]

These results have clarified that the effect for enhancing the *umami* of *tatsuta-age* is obtained such that the *umami* is stronger in *tatsuta-age* fried using an oil and fat composition for cooking with heat that contains the oxidation treatment product of the red palm oil than in *tatsuta-age* fried using an oil and fat composition for cooking with heat that does not contain the oxidation treatment product of the red palm oil, due to the oxidation treatment product of the red palm oil in the former.

10

CLAIMS

1. An *umami*-enhancing composition having an oxidation treatment product of a palm-based oil and fat as an active ingredient.

5 2. The *umami*-enhancing composition according to claim 1, wherein the peroxide value of the oxidation treatment product is 3 or greater and 250 or lower.

3. The *umami*-enhancing composition according to claim 1 or 2, wherein the total α -carotene and β -carotene content of
10 the palm-based oil and fat is 30 mass ppm or more and 2000 mass ppm or less.

4. The *umami*-enhancing composition according to any of claims 1 to 3, wherein the *umami*-enhancing composition is in the form of an edible oil and fat composition.

15 5. A seasoning or extract that contains the *umami*-enhancing composition according to any of claims 1 to 4.

6. An oil and fat composition for cooking with heat that contains the *umami*-enhancing composition according to any of claims 1 to 4.

20 7. A method for manufacturing a heat-cooked food, the method being characterized in that a food is cooked with heat using the oil and fat composition for cooking with heat according to claim 6.

8. A method for manufacturing an *umami*-enhancing
25 composition, the method including a step in which a palm-based oil and fat in which the total α -carotene and β -carotene

content is 30 mass ppm or more and 2000 mass ppm or less is subjected to an oxidation treatment such that the peroxide value reaches 3 or greater and 250 or lower.

9. The method for manufacturing an *umami*-enhancing composition according to claim 8, wherein the oxidation treatment is carried out through heat treatment at 50°C or greater and 220°C or lower for 0.1 hour or more and 240 hours or less.

10. The method for manufacturing an *umami*-enhancing composition according to claim 9, wherein the heat treatment involves supplying oxygen.

11. The method for manufacturing an *umami*-enhancing composition according to any of claims 8 to 10, wherein, after the step for conducting an oxidation treatment has been completed, there is furthermore included a step for mixing with an edible oil and fat.

12. A method for manufacturing a seasoning or extract, the method including a step for mixing an *umami* component and an *umami*-enhancing composition obtained through the manufacturing method according to any of claims 8 to 10.

13. A method for enhancing the *umami* of a food product, the method involving imparting the *umami*-enhancing composition according to any of claim 1 to 4 to a food product.

14. The method for enhancing the *umami* of a food product according to claim 13, wherein the oxidation treatment product is incorporated into the food product in an amount of 1×10^{-6}

mass ppm or more and 1000 mass ppm or less.