

Description

METHOD FOR PRODUCING SEASONING FOR IMPARTING MATURE FLAVOR

Technical Field

The present invention relates to a method for producing a seasoning capable of imparting a strong, high-quality mature flavor to a food or beverage, and also to use of the seasoning.

Background Art

In recent years, for the purpose of authentically seasoning foods and beverages, seasonings that impart *kokumi* (rich flavor) are widely used. In order to achieve authentic flavor, sufficient mature flavors are desired even in processed foods produced in a short time. As seasonings capable of imparting ordinary *kokumi*, those obtained from a protein hydrolysate, an animal extract, or a yeast extract, those obtained by a heating reaction thereof with a saccharide or the like, and so forth have been used in various food products.

For example, a technique related to a seasoning having an excellent roasted-meat-like flavor is known, characterized in that a saccharide and optionally an amino acid are added to a yeast extract containing a sulfur-containing compound, and then heated (see Patent Document 1).

Another technique related to a seasoning having an excellent roasted-meat-like flavor is also known, characterized by including heating an aqueous solution containing a 5'-nucleotide-containing yeast extract, a glutathione yeast extract, a monosaccharide, dextrin, and salt, etc (see Patent Document 2).

Regarding the mature flavor, for *kaeshi* that is a mixture of a soy sauce with *mirin* (sweet sake) and a sweet saccharide, for example, a technique for imparting a mature flavor to *kaeshi* within a short period of time is under development.

For example, the following methods are known: a method for producing *kaeshi*, including adding a sweet saccharide to a soy sauce, then allowing the mixture to flow on a wall surface while the mixture being exposed to air (see Patent Document 3); a method for producing *kaeshi*, including adding *mirin*, a sweet saccharide, and the like to soy sauce, then placing the mixture in an open container, and mixing the same with a predetermined power required for stirring (see Patent Document 4); a production method including mixing a saccharide and/or *mirin* with a soy sauce, storing the thus-obtained preparation in a container, and then forcibly blowing air into the container to bring the preparation into contact with air in the form of bubbles, thereby causing maturation (see Patent Document 5); etc.

Patent Document 1

JP-A-04-66069

Patent Document 2

JP-A-2003-169627

Patent Document 3

JP-A-2003-61608

Patent Document 4

JP-A-2001-145470

Patent Document 5

JP-A-2005-287433

Disclosure of the Invention

However, the invention of Patent Document 1 mentioned above is not aimed to impart a mature flavor but is aimed to obtain a seasoning having an excellent, roasted-meat-like flavor. Therefore, the sulfur-containing compound and the saccharide are required to be heated to react at a high temperature of 70°C to 180°C. Further, there is a restriction that it should be performed in the absence of fat.

Also, the invention of Patent Document 2 mentioned above is not aimed to impart a mature flavor but aimed to obtain a seasoning having an excellent, meat-like flavor. Therefore, the seasoning is required to contain all of the 5'-nucleotide-containing yeast extract, glutathione-containing yeast extract, monosaccharide, dextrin, and salt, and be heated to react.

Patent Document 3, Patent Document 4, and Patent Document 5 mentioned above are all aimed to provide *kaeshi* with a mature flavor, and are characterized by using soy sauces. There is no problem in these methods in the case where the tastes and flavors from soy sauce are desired. However, in the case where only the provision of a food or beverage with a mature flavor is desired, and tastes and flavors from soy sauce are not desired, when such a method is used, the resulting food product will lose the balance of tastes and flavors. Therefore, the above methods are difficult to be widely used, and are problematic in this respect.

Against the above background, an object of the preset invention is to provide a seasoning capable of easily and widely imparting a mature flavor to a food product, which has heretofore required a long period of time to achieve.

The present inventors conducted extensive research to solve the above problems, and as a result accomplished the invention. The invention encompasses the following embodiments.

1) A method for producing a seasoning, including a step of conducting an oxidation reaction of an amino acid source and/or a peptide source and a saccharide source, the amino acid source and/or the peptide source not being a soy sauce, characterized in that:

the oxidation reaction includes a step supplying an

oxygen-containing gas and/or stirring; and

the oxidation reaction is conducted at a temperature of 20°C to 50°C for a period of 0.5 hours to 48 hours.

2) A method for producing a seasoning according to 1) above, wherein the amino acid source and/or the peptide source is a yeast extract or a protein hydrolysate produced through a decolorization step and/or a deodorization step.

3) A method for producing a seasoning according to 1) above, wherein oxygen is supplied at a supply rate of 10 ml to 300 ml of air/min per 100 g of seasoning for a supply period of 1 hour to 48 hours.

4) A method for producing a seasoning according to 1) above, wherein oxygen is supplied by stirring with a stirring power of 0.1 W to 200 W per kg of seasoning in contact with air.

5) A method for producing a seasoning according to any one of 1) to 4) above, characterized in that prior to mixing with the saccharide source, the amino acid source and/or the peptide source is pre-heated at 50°C to 100°C for 0.5 hours to 24 hours.

6) A seasoning produced by a method according to any one of 1) to 5) above.

7) A food or beverage comprising a seasoning produced by a method according to any one of 1) to 5) above in amount of 0.01% to 99% based on the food or beverage.

8) A mature-flavor-imparting agent produced by a method according to any one of 1) to 5) above.

The invention also encompasses any combination of these configurations. Further, the expression thereof may also be replaced with a composition, an apparatus, etc.

The invention makes it possible to provide a seasoning capable of imparting a strong, high-quality mature flavor to foods and beverages.

Best Mode of Carrying Out the Invention

"Mature flavor" herein relates to *kokumi* that is a concept based on flavors and tastes. Of several types of *kokumi*, a flavor with improved harmony, mouthfulness, and body is defined as a mature flavor. "Harmony" herein means a mild, well-balanced taste without a lack of harmony. "Mouthfulness" herein means the fullness of taste or flavor in the mouth. "Body" herein means a robust taste suitable as the basis of taste.

The materials for the amino acid source and the peptide source used in the invention may be any nitrogen sources that are usable for foods and beverages. An amino acid and a peptide may also be used to achieve the object. However, yeast extracts, fermented seasonings, hydrolyzed vegetable proteins and like protein hydrolysates, meat extracts, seafood extracts, fish sauces, and so forth are preferable in terms of industrial

production for their high availability at low cost.

Examples of yeast extracts include baker's yeast extracts, beer yeast extracts, and torula yeast extracts. Any of these can be used as long as they are edible. The extraction method for such a yeast extract is not limited either, and examples thereof include, but are not limited to, autolysis, enzymolysis, and hydrothermal decomposition.

The protein hydrolysate is not limited either as long as it is edible. A fermented seasoning or a hydrolyzed vegetable protein is preferable, because the peculiar flavor thereof is weak, and amino acid/peptide sources are abundantly contained therein. In the invention, a fermented seasoning means a protein hydrolysate of mixture of protein, such as soybean or wheat, with a liquid koji, solid a koji, or a breakdown enzyme. In the invention, use of a soy sauce as the nitrogen source also allows a mature flavor to be imparted. However, because of the presence of the taste and flavor peculiar to soy sauce, this is not preferable for the purpose of enhancing only the mature flavor.

A soy sauce refers to any of those produced by authentic brewing, mixed brewing, or mixing. With respect to kinds of thereof, the Japanese Agricultural Standards (JAS) provides definitions of five kinds: dark soy sauce, light soy sauce, tamari soy sauce, double-fermented soy sauce, and white soy sauce.

In the invention, as the materials for suppressing tastes and flavors other than the mature flavor (undesired tastes and undesired flavors), the following fermented seasonings are mentioned.

An example 1 of a method for producing a preferred fermented seasoning is the following method for producing a seasoning, characterized by including: (1) a step of inoculating microorganisms capable of hydrolyzing protein onto a defatted-soybean-containing medium to produce a solid koji; and (2) a step of adding a brewing liquid to the obtained solid koji to make a specific salt concentration, thereby preparing *moromi* (unrefined soy sauce), so as to cause protein hydrolysis. The method further includes allowing the *moromi* to act at 5 to 45°C for 40 to 144 hours at such a salt concentration that does not inhibit protein hydrolysis. By using a fermented seasoning produced by this method as the amino acid source and/or the peptide source, the development of undesired flavors and undesired tastes is suppressed. Especially, the resulting mature flavor has increased strength and improved balance. Such a fermented seasoning is thus extremely preferable.

An example 2 of a preferred fermented seasoning is one obtained by the following method for producing a seasoning, characterized by including allowing a microorganism culture with enhanced glutaminase activity, such as *Aspergillus oryzae*

or a yeast, to act on protein, such as wheat gluten, in the presence of a protease under salt-free conditions or conditions with a salt concentration of 3% (w/v) or less. By using a fermented seasoning produced by this method as the amino acid source and/or the peptide source, the development of undesired flavors and undesired tastes is suppressed. Especially, the resulting mature flavor has increased strength and improved balance. Such a fermented seasoning is thus extremely preferable.

An example 3 of a preferred fermented seasoning is one obtained by the following method for producing a seasoning, including a step of, using defatted soybean as a main ingredient, preparing a solid koji using *Aspergillus oryzae*, thereby producing a liquid seasoning. The method is characterized in that in the above step of producing a liquid seasoning, a culture medium of bacteriocin-producing lactic acid bacteria or a supernatant thereof is added to prepare the koji, and then, the obtained koji is mixed with saline having a salt concentration of 13 to 17 wt% in an amount of 1.8 to 3.0 times (weight) the koji weight to prepare *moromi*, followed by hydrolysis of the *moromi* at 32 to 40°C for 11 to 19 days. By using a fermented seasoning produced by this method as the amino acid source and/or the peptide source, the development of undesired flavors and undesired tastes is suppressed. Especially, the resulting mature flavor has increased strength

and improved balance. Such a fermented seasoning is thus extremely preferable.

A hydrolyzed vegetable protein is obtained by hydrolysis of protein, such as soybean or wheat, in the presence of an acid, such as hydrochloric acid.

The saccharide source in the invention is not limited as long as it is usable for foods and beverages. Examples of saccharide sources include sucrose, glucose, fructose, xylose, and isomerized sugar. Among these, sucrose and glucose are particularly preferable, because they further enhance the mature flavor. The amount of saccharide source to be used is not limited as long as the desired seasoning can be obtained. For example, the saccharide source may be used in an amount of 0.01 to 10 parts by weight per part by weight of amino acid source or peptide source.

When the saccharide source proportion is lower than this range, the resulting mature flavor is weak, and this thus is undesirable.

When the saccharide source proportion is higher than this range, this causes undesired smells (flavors) and tastes, such as a burnt smell and a bitter taste, and thus is undesirable.

It is also important in the invention to allow an amino acid source and/or a peptide source to undergo an oxidation reaction with a saccharide source. The oxidation reaction is not limited. For example, an oxidation reaction can be

effected by placing the amino acid source and/or the peptide source together with a saccharide into a cooking pot or a like apparatus where the temperature can be controlled, and then supplying air or a like oxygen-containing gas to these materials or stirring these materials. The gas herein can be supplied by blowing the gas directly into the liquid mixture using an air hose or the like or by blowing the gas into the head space in a closed container. The gas is preferably supplied at a supply rate of 10 to 300 ml of air/min per 100 g of seasoning for a supply period of 1 hour to 48 hours, and more preferably at a supply rate of 30 to 120 ml of air/min per 100 g of seasoning for a supply period of 2 hours to 12 hours. The calculation is based on the assumption that air contains 21% oxygen. To effect an oxidation reaction by stirring means to strongly stir a liquid seasoning using a homogenizer, a homomixer, a dispersion mixer, or the like so as to take a gas into the liquid seasoning. The stirring power is preferably 0.1 W to 200 W per kg of seasoning, and more preferably 0.3 W to 50 W per kg of seasoning. When the supply or stirring is weak, a sufficient mature flavor is not obtained. When the supply or stirring is too strong, undesired tastes such as acridity and undesired flavors are developed, and only specific kinds of *kokumi* strongly develop, losing the balance of tastes. This thus is undesirable.

The oxidation reaction in the invention is conducted

preferably at a temperature of 20°C to 50°C for a period of 0.5 hours to 48 hours, and more preferably at a temperature of 20°C to 50°C for a period of 3 hours to 24 hours. When the temperature of the oxidation reaction is less than 20°C, the resulting mature flavor is weak, and also, the production takes a longer time, increasing the cost, which is industrially problematic. Further, when the temperature of the oxidation reaction is 60°C or more, this causes a burnt smell (flavor) or undesired tastes including bitterness and acidity, and thus is undesirable. Prior to the oxidation reaction of the amino acid source and/or the peptide source with the saccharide source, only the amino acid source and the peptide source, such as a yeast extract or a protein hydrolysate, is preferably preheated to further enhance the mature flavor. Preheating is conducted preferably at a temperature of 50°C to 100°C for a period of 0.1 hours to 24 hours, and more preferably at a temperature of 50°C to 90°C for a period of 0.5 hours to 6 hours. When preheating is performed at a lower temperature or for a shorter period of time, the resulting mature flavor is weak, and also, the production takes longer, increasing the cost, which is industrially problematic. When the preheating is performed at a higher temperature or for a longer period of time, this causes undesired smells (flavors), such as a burnt smell and a stuffy smell, and undesired tastes, such as acidity and bitterness, and thus is undesirable.

In the invention, it was newly found that the components that contribute to the mature flavor increase through the oxidation reaction or the preheating only of the amino acid source and the peptide source.

The decolorization step and the deodorization step in the invention can be performed by bringing a material into contact with activated carbon, ion exchange resin or the like, alumina, etc., by subjecting a material steam distillation or film processing, or by any other methods.

The seasoning obtained by the invention can be widely used for sauces, soups, fermented foods, and like foods and beverages. The seasoning is particularly suitable for application to sauces and soups, because this reproduces *kokumi* (mature flavor) with extremely high quality, which has been heretofore unobtainable without long-term fermentation. With respect to the seasoning obtained in the invention, the amount thereof to be added to a food or beverage is not limited. Generally, the seasoning may be added in an amount of 0.01% or 99% based on the food or beverage. The seasoning is preferably added in an amount of 0.05% to 20% based on the food or beverage, and more preferably in an amount of 0.1% to 5% based on the food or beverage. When the proportion of seasoning is too low, the addition thereof is less effective, and this thus is undesirable. When the proportion of seasoning is too high, although this is not problematic in terms of the

mature flavor, such a large amount is usually unnecessary, and a smaller amount is sufficiently effective.

Further, the invention also provides a mature-flavor-imparting agent used for a food or beverage. The form of the mature-flavor-imparting agent is not limited. In terms of keeping quality and ease of use, the agent is preferably in the form of a powder, a liquid, or a paste, for example.

Examples

Hereinafter, the invention will be explained in further detail with reference to the examples. However, the technical scope of the invention is not limited thereto.

(Example 1: Difference in Effects of Addition of Seasoning to *Men-Tsuyu* (Soup for Noodles) due to Difference in Kinds of Amino Acid Source and/or Peptide Source)

1. Selection of Amino Acid Source and/or Peptide Source

The following materials were used as amino acid sources and/or peptide sources.

- Soy sauce (dark soy sauce, manufactured by HIGETA SHOUYU, total nitrogen: T-N = 1.6%)
- Hydrolyzed vegetable protein (light "MIEKI", produced by AJINOMOTO)
- Yeast extract (Yeast Extract No.1, manufactured by

AJINOMOTO)

- Fermented seasoning ("Koji Base", manufactured by AJINOMOTO)
- Decolorized and deodorized, fermented seasoning (obtained by adding 2 parts by weight of activated carbon ("Hokuetsu BA", manufactured by AJINOMOTO FINE-TECHNO) to 100 parts by weight to "Koji Base", and then stirring at 24°C for 24 hours, followed by removal of activated carbon by filtration. At a wavelength of 545 nm, the absorbance of the original fermented seasoning was 0.7, while this decolorized and deodorized, fermented seasoning had a reduced absorbance of 0.2.)

2. Production of Oxidized Liquid Seasonings

In a 300-ml beaker, 180 ml of each of various amino acid sources and/or peptide sources (each amino acid source and/or peptide source was adjusted with water so that the total nitrogen amount T-N = 2.9 g. The soy sauce 180 ml used in the example had a T-N amount of 2.9 g, so was not adjusted with water) was mixed with 32 g of granulated sugar and 18 g of *mirin* ("TaKaRa Hon-Mirin, Junmai", manufactured by TAKARA SHUZO), and heated at 80°C for 10 minutes, to give a liquid seasoning. The temperature of each liquid seasoning was subsequently controlled at 30°C, and air was then supplied to the liquid seasoning from the bottom of the beaker using a silicon tube (outer diameter: 6 mm, inner diameter: 4 mm) and a ceramic air stone (outer diameter: 17 mm, length: 20 mm) from an air compressor. The air was supplied at a rate of 30 ml/min per

100 g of liquid seasoning, at a temperature of 30°C, and for a period of 24 hours.

3. Sensory Evaluation of Oxidized Liquid Seasonings

Each of the above-mentioned liquid seasonings produced by oxidation using as materials various amino acid sources and/or peptide sources were added to *men-tsuyu* ("Ninben Tsuyu no Moto" manufactured by NINBEN) in a proportion of 1% of *men-tsuyu*, and subjected to sensory evaluation. In sensory evaluation, the samples (n = 10) were evaluated for *kokumi* (harmony, mouthfulness, body) and a mature flavor. Using *men-tsuyu* with no liquid seasoning added as control (score of 0), the results were rated on a scale of 0: absent, 1: slightly strong, 2: strong, and 3: extremely strong.

Further, 32 g of granulated sugar and 18 g of *mirin* were mixed with 180 ml of soy sauce (dark soy sauce, manufactured by HIGETA SHOUYU), and heated at 80°C for 10 minutes to give a liquid seasoning. The liquid seasoning was then stored in a breathable PET bottle for use as *kaeshi*. *Kaeshi* stored for 0 days (immediately after the start of storage) and one stored for 14 days were evaluated as reference to determine the mature-flavor-imparting effects of ordinary *kaeshi*. The results are shown in Table 1.

Table 1

Difference in Effects of Addition of Seasoning to *Men-Tsuyu* due to Difference in Kinds of Amino Acid Source and/or

Peptide Source

Amino Acid Source and/or Peptide Source	<i>Kokumi</i>			Mature Flavor	Comments
	Harmo ny	Mouthf ulness	Body		
Soy sauce	1.0	1.0	1.0	1.0	Burnt smell (undesired flavor), Bitterness
Hydrolyzed vegetable protein	1.4	2.0	1.4	1.6	Weak smell of hydrolyzed vegetable protein (undesired flavor)
Yeast extract	2.0	2.0	2.6	2.2	Weak fermented smell (undesired flavor)
Fermented seasoning	2.2	2.2	2.2	2.2	Weak stuffy smell (undesired flavor)
Decolorized and deodorized, fermented seasoning	3.0	3.0	2.6	3.0	No undesired flavors
(Reference 1) Soy sauce <i>kaeshi</i> stored for 0 days	0.0	0.0	0.0	0.0	Strong smell of soy sauce
(Reference2) Soy sauce <i>kaeshi</i> stored for 14 days	2.0	2.0	2.0	2.0	Smell of soy sauce, Weak burnt smell (undesired flavor)

The results of sensory evaluation shown in Table 1 indicate that especially in the cases of using a hydrolyzed vegetable protein, a yeast extract, and a fermented seasoning, the resulting *kokumi* is stronger, the development of undesired flavors and tastes is suppressed, and the desired mature flavor is obtained. The results further show that in the case of the system using the decolorized and deodorized, fermented seasoning treated with activated carbon, the resulting *kokumi* is strong, so is the mature flavor.

In the above-mentioned sensory evaluation, the liquid seasonings oxidized using as materials various amino acid sources and/or peptide sources were added to *men-tsuyu* in a

proportion of 1%, and such *men-tsuyu* samples were subjected to sensory evaluation. Meanwhile, sensory evaluation was also performed on demiglace sauces, instead of *men-tsuyu*, having the seasonings added thereto in a proportion of 1% and on five-fold water dilutions of the seasonings. As a result, the same tendency was observed.

(Example 2: Difference in Effects of Addition of Seasoning to *Men-Tsuyu* due to Differences in Oxidation Reaction Conditions of Temperature and Time)

1. Production of Liquid Seasonings under Varying Oxidation Reaction Conditions of Temperature and Time

In a 3000-ml beaker, 1550 g of fermented seasoning ("Koji Base", manufactured by AJINOMOTO), 300 g of granulated sugar, and 150 g of water were mixed, and heated at 80°C for 10 minutes to give a liquid seasoning. The temperature of the liquid seasoning was subsequently controlled at 30°C, and air was then supplied to the liquid seasoning from the bottom of the beaker using a silicon tube (outer diameter: 6 mm, inner diameter: 4 mm) and a ceramic air stone (outer diameter: 17 mm, length: 20 mm) from an air compressor. The air was supplied at a rate of 30 ml/min per 100 g of liquid seasoning, at temperatures of 20 to 70°C, and for periods of 1 to 24 hours.

2. Sensory Evaluation of Oxidized Liquid Seasonings

Each of the above-mentioned liquid seasonings oxidized

under varying temperature and time conditions was added to *men-tsuyu* ("Ninben Tsuyu no Moto" manufactured by NINBEN) in a proportion of 1%, and subjected to sensory evaluation. In sensory evaluation, the samples (n = 10) were evaluated for *kokumi* (harmony, mouthfulness, body) and a mature flavor. Using *men-tsuyu* with no liquid seasoning added as control (score of 0), the results were rated on a scale of 0: absent, 1: slightly strong, 2: strong, and 3: extremely strong.

The results are shown in Table 2.

Table 2

Difference in Effects of Addition of Seasoning to *Men-Tsuyu* due to Differences in Oxidation Reaction Conditions of Temperature and Time

Temperature (°C) × Time (hr)	<i>Kokumi</i>			Mature Flavor	Comments
	Harmony	Mouthfulness	Body		
20°C × 24 hr	2.0	2.5	2.5	2.3	Mild characteristics
30°C × 12 hr	2.5	2.2	2.5	2.4	
40°C × 4 hr	3.0	2.5	3.0	2.8	
50°C × 3 hr	2.5	2.0	2.0	2.1	Slight burnt smell, Sharp characteristics
60°C × 2 hr	2.0	1.5	2.0	1.8	Burnt smell, Sharp characteristics

The results of sensory evaluation shown in Table 2 indicate that when the oxidation reaction is performed at a temperature of 20°C to 50°C for a heating period of 3 hours to 24 hours, this results in the prevention of undesired flavors

and also in the enhancement of the mature flavor. For obtaining a strong mature flavor within a short period of time, a reaction at a temperature of 40°C for a period of approximately 4 hours is preferable; such conditions resulted in a high-quality seasoning without undesired flavors.

In the above-mentioned sensory evaluation, the liquid seasonings produced under varying oxidation reaction conditions were each added to *men-tsuyu* in a proportion of 1%, and such *Men-Tsuyu* samples were subjected to sensory evaluation. Meanwhile, sensory evaluation was also performed on demiglace sauces, instead of *men-tsuyu*, having the seasonings added thereto in a proportion of 1% and on five-fold water dilutions of the seasonings. As a result, the same tendency was observed.

(Example 3: Difference in Effects of Addition of Seasoning to *Men-Tsuyu* due to Differences in Oxidation Reaction Conditions of Oxygen Amount and Time)

1. Production of Liquid Seasonings under Varying Oxidation Reaction Conditions of Oxygen Amount and Time

In a 3000-ml beaker, 1550 g of fermented seasoning ("Koji Base", manufactured by AJINOMOTO), 300 g of granulated sugar, and 150 g of water were mixed, and heated at 80°C for 10 minutes to give a liquid seasoning. The temperature of the liquid seasoning was subsequently controlled at 30°C, and air was then

supplied to the liquid seasoning from the bottom of the beaker using a silicon tube (outer diameter: 6 mm, inner diameter: 4 mm) and a ceramic air stone (outer diameter: 17 mm, length: 20 mm) from an air compressor. The air was supplied at a temperature of 30°C, at rates of 0 to 400 ml/min per 100 g of liquid seasoning, and for periods of 1 to 12 hours.

2. Sensory Evaluation of Oxidized Liquid Seasonings

Each of the above-mentioned liquid seasonings oxidized under varying air supply conditions and time conditions was added to *men-tsuyu* ("Ninben Tsuyu no Moto" manufactured by NINBEN) in a proportion of 1%, and subjected to sensory evaluation. In sensory evaluation, the samples (n = 10) were evaluated for *kokumi* (harmony, mouthfulness, body) and a mature flavor. Using *men-tsuyu* with no liquid seasoning added as control (score of 0), the results were rated on a scale of 0: absent, 1: slightly strong, 2: strong, and 3: extremely strong.

The results are shown in Table 3.

Table 3

Difference in Effects of Addition of Seasoning to
Men-Tsuyu due to Differences in Oxidation Reaction Conditions
of Air Supply Rate and Time

Air Supply Rate (ml/min) × Time (hr)	Kokumi			Mature Flavor	Comments
	Harmony	Mouthfulness	Body		
240 ml/min × 3 hr	1.5	1.0	1.5	1.1	Slight bitterness
240 ml/min × 2 hr	1.3	1.1	1.3	1.1	Slight lack of harmony is present in the taste of salt (undesired taste)
240 ml/min × 1 hr	1.0	1.0	1.0	1.0	Slight lack of harmony is present in the taste of salt (undesired taste)
120 ml/min × 8 hr	2.0	1.5	1.8	1.8	Slight lack of harmony is present in the taste of salt (undesired taste)
120 ml/min × 4 hr	2.3	2.2	2.3	2.3	Slight lack of harmony is present in the taste of salt (undesired taste)
60 ml/min × 8 hr	2.3	2.2	2.3	2.3	
60 ml/min × 4 hr	2.0	2.0	1.8	2.0	
60 ml/min × 2 hr	1.3	1.5	1.3	1.4	
30 ml/min × 12 hr	2.5	2.2	2.5	2.4	
30 ml/min × 8 hr	2.3	2.2	2.3	2.3	
30 ml/min × 4 hr	1.3	1.5	1.3	1.4	
0 ml/min × 12 hr	0.0	0.0	0.0	0	

The results of sensory evaluation shown in Table 3
indicate that the oxidation reaction is effective when

conducted at an air supply rate of 10 to 300 ml/min, more preferably 30 to 120 ml/min, per 100 g of liquid seasoning. The results also show that the oxidation reaction is effective when conducted for a period of 1 to 48 hours, and that an oxidation reaction period of 2 hours to 12 hours results in a further enhanced mature flavor.

In the above-mentioned sensory evaluation, the liquid seasonings produced under varying oxidation reaction conditions were each added to *men-tsuyu* in a proportion of 1%, and such *men-tsuyu* samples were subjected to sensory evaluation. Meanwhile, sensory evaluation was also performed on demiglace sauces, instead of *men-tsuyu*, having the seasonings added thereto in a proportion of 1% and on five-fold water dilutions of the seasonings. As a result, the same tendency was observed.

(Example 4: Difference in Effects of Addition of Seasoning to *Men-Tsuyu* due to Differences in Stirring Conditions in Oxidation Reaction)

1. Production of Liquid Seasonings under Varying Stirring Conditions in Oxidation Reaction

In a 3000-ml beaker, 1550 g of fermented seasoning ("Koji Base", manufactured by AJINOMOTO), 300 g of granulated sugar, and 150 g of water were mixed, and heated at 80°C for 10 minutes to give a liquid seasoning. The temperature of the liquid

seasoning was subsequently controlled at 30°C, and the liquid seasoning was stirred using a homodisperser (T.K. Robomix, manufactured by TOKUSHU KIKI KOGYO) at a temperature of 30°C, at rotational speeds of 0 to 5000 rpm, homodisperser and for periods of 1 to 5 hours.

2. Sensory Evaluation of Oxidized Liquid Seasonings

Each of the above-mentioned liquid seasonings stirred at varying rotational speeds for varying periods was added to *men-tsuyu* ("Ninben Tsuyu no Moto" manufactured by NINBEN) in a proportion of 1%, and subjected to sensory evaluation. In sensory evaluation, the samples (n = 10) were evaluated for *kokumi* (harmony, mouthfulness, body) and a mature flavor. Using *men-tsuyu* with no liquid seasoning added as control (score of 0), the results were rated on a scale of 0: absent, 1: slightly strong, 2: strong, and 3: extremely strong.

The results are shown in Table 4.

Table 4

Difference in Effects of Addition of Seasoning to Men-Tsuyu due to Differences in Stirring
Conditions in Oxidation Reaction

Rotational speed (rpm) × Time (hr)	Kokumi			Mature Flavor	Comments	Amount of Dissolved Oxygen upon Completion of Stirring (in 3 hours) (%)
	Harmony	Mouthfulness	Body			
0 rpm × 3 hr	0.5	0.7	0.5	0.5	Smell of materials (undesired flavor)	0
1500 rpm × 3 hr	2.0	2.5	2.0	2.2		36
2500 rpm × 1 hr	1.5	1.5	1.2	1.4		95
2500 rpm × 3 hr	3.0	2.8	3.0	2.9		100
2500 rpm × 5 hr	3.0	2.5	3.0	2.6	Weak acidity	100
3500 rpm × 3 hr	3.0	2.2	3.0	2.7		56
5000 rpm × 3 hr	2.3	1.5	2.5	2.2	Acridity	56

The results of sensory evaluation shown in Table 4 confirm that a homomixer, a dispersion mixer, or a like stirring apparatus can be used for supplying air. The results also show that stirring at a rotational speed of 1500 to 3500 rpm for a period of 1 hour to 5 hours results in an enhanced mature flavor, and further that a stirring period of 3 hours to 5 hours results in a further enhanced mature flavor. When the rotational speed was too high or stirring was continued for a long period of time, undesired tastes such as acidity developed, showing undesirable results.

In the above-mentioned sensory evaluation, the liquid seasonings produced under varying oxidation reaction conditions were each added to *men-tsuyu* in a proportion of 1%, and such *men-tsuyu* samples were subjected to sensory evaluation. Meanwhile, sensory evaluation was also performed on demiglace sauces, instead of *men-tsuyu*, having the seasonings added thereto in a proportion of 1% and on five-fold water dilutions of the seasonings. As a result, the same tendency was observed.

(Example 5: Difference in Effects of Addition of Seasoning to *Men-Tsuyu* due to Differences in Kinds of Saccharide Sources)

1. Production of Liquid Seasonings from Different Saccharide Sources

In a 300-ml beaker, a saccharide source (35 g of sucrose,

23 g of glucose, 20 g of fructose, or 15 g of xylose) was mixed with 180 ml of fermented seasoning ("Koji Base", manufactured by AJINOMOTO), and heated at 80°C for 10 minutes to give a liquid seasoning. The reason that the amounts of saccharide sources were different is that the amounts were adjusted so that all the saccharide sources had an almost equal number of moles. The temperature of each liquid seasoning was subsequently controlled at 30°C, and air was then supplied to the liquid seasoning from the bottom of the beaker using a silicon tube (outer diameter: 6 mm, inner diameter: 4 mm) and a ceramic air stone (outer diameter: 17 mm, length: 20 mm) from an air compressor. The air was supplied at a rate of 30 ml/min per 100 g of liquid seasoning, at a temperature of 30°C, and for a period of 12 hours.

2. Sensory Evaluation of Liquid Seasonings

Each of the above-mentioned liquid seasonings produced from different saccharide sources was added to *men-tsuyu* ("Ninben Tsuyu no Moto" manufactured by NINBEN) in a proportion of 1%, and subjected to sensory evaluation. In sensory evaluation, the samples (n = 10) were evaluated for *kokumi* (harmony, mouthfulness, body) and a mature flavor. Using *men-tsuyu* with no liquid seasoning added as control (score of 0), the results were rated on a scale of 0: absent, 1: slightly strong, 2: strong, and 3: extremely strong.

The results are shown in Table 5.

Table 5

Difference in Effects of Addition of Seasoning to
Men-Tsuyu due to Differences in Kinds of Saccharide Sources

Saccharide source	Kokumi			Mature Flavor	Comments
	Harmony	Mouthfulness	Body		
Sucrose (= granulated sugar) 35 g	2.5	2.3	2.5	2.4	
Glucose (= grape sugar) 23 g	1.3	1.3	1.5	1.4	
Fructose (= fruit sugar) 20 g	1.5	1.5	1.5	1.5	Undesirable acidity
Xylose 15 g	2.3	1.5	2.0	2.0	Burnt smell

The results of sensory evaluation shown in Table 5 indicate that when sucrose or glucose is used as the saccharide source, this results in a more excellent, enhanced mature flavor without undesired flavors and tastes.

In the above-mentioned sensory evaluation, the liquid seasonings produced from different saccharide sources were each added to *men-tsuyu* in a proportion of 1%, and such *men-tsuyu* samples were subjected to sensory evaluation. Meanwhile, sensory evaluation was also performed on demiglace sauces, instead of *men-tsuyu*, having the seasonings added thereto in a proportion of 1% and on five-fold water dilutions of the seasonings. As a result, the same tendency was observed.

(Example 6: Difference in Effects of Addition of Seasoning to

Men-Tsuyu due to Differences in Pre-Heating Conditions)

1. Production of Liquid Seasonings under Varying Preheating Conditions

In a 3000-ml beaker, 1550 g of fermented seasoning ("Koji Base", manufactured by AJINOMOTO) was pre-heated. The preheating was performed at temperatures of 50 to 90°C for periods of 0.5 to 6 hours. Subsequently, each of the pre-heated fermented seasonings was mixed with 300 g of granulated sugar and 150 g of water, and then heated at 80°C for 10 minutes to give a liquid seasoning. Subsequently, the temperature of each liquid seasoning was controlled at 40°C, and air was then supplied to the liquid seasoning from the bottom of the beaker using a silicon tube (outer diameter: 6 mm, inner diameter: 4 mm) and a ceramic air stone (outer diameter: 17mm, length: 20 mm) from an air compressor. The air was supplied at a rate of 30 ml/min per 100 g of liquid seasoning, at a temperature of 40°C, and for a period of 4 hours.

2. Sensory Evaluation of Liquid Seasonings

Each of the above-mentioned liquid seasonings pre-heated and then oxidized was added to *men-tsuyu* ("Ninben Tsuyu no Moto" manufactured by NINBEN) in a proportion of 1%, and subjected to sensory evaluation. In sensory evaluation, the samples (n = 10) were evaluated for *kokumi* (harmony, mouthfulness, body) and a mature flavor. Using *men-tsuyu* with no liquid seasoning added as control (score of 0), the results

were rated on a scale of 0: absent, 1: slightly strong, 2: strong, and 3: extremely strong.

The results are shown in Table 6.

Table 6

Difference in Effects of Additions of Seasoning to
Men-Tsuyu due to Differences in Pre-Heating Conditions

Temperature (°C) × Time (hr)	<i>Kokumi</i>			Mature Flavor	Comments
	Harmon y	Mouthf ulness	Body		
90 × 0.5	2.2	2.2	2.2	2.2	
90 × 1	2.0	1.5	2.5	1.8	Slight burnt smell
80 × 1	2.8	2.6	2.6	2.7	
80 × 2	2.3	2.3	2.3	2.3	
70 × 1	2.8	2.8	2.8	2.8	
70 × 2	3.0	2.9	2.9	2.9	
70 × 3	2.0	2.0	2.8	2.2	
60 × 3	1.3	1.3	1.3	1.3	Slight dull flavor (undesired flavor)
60 × 4	1.5	1.3	1.3	1.3	Dull flavor (undesired flavor)
50 × 4	1.2	1.2	1.2	1.2	Dull flavor (undesired flavor)
50 × 6	1.3	1.3	1.3	1.3	Dull flavor (undesired flavor)

The results of sensory evaluation shown in Table 6 indicate that when the amino acid source and/or peptide source is pre-heated for a temperature of 70°C to 80°C for a period of 1 hour to 2 hours, this results in the most enhanced mature flavor.

In the above-mentioned sensory evaluation, the liquid seasonings produced under varying pre-heating conditions were

each added to *men-tsuyu* in a proportion of 1%, and such *men-tsuyu* samples were subjected to sensory evaluation. Meanwhile, sensory evaluation was also performed on demiglace sauces, instead of *men-tsuyu*, having the seasonings added thereto in a proportion of 1% and on five-fold water dilutions of the seasonings. As a result, the same tendency was observed.

(Example 7: Effects of Addition of Seasoning of the Invention to Food or Beverage)

The seasoning produced in Example 6 under preheating conditions of 70°C and 2 hours was defined as "invention product 6 (70 × 2)." The invention product 6 (70 × 2) was mixed with commercial *soba-tsuyu* (soup for buckwheat noodles) ("Zarusoba-Tsuyu", manufactured by KIKKOMAN), demiglace sauce ("Demiglace Sauce" manufactured by HEINZ JAPAN), sukiyaki sauce ("Sukiyaki no Tare", manufactured by EBARA FOODS), or barbecue sauce ("Ogon no Tare, Chu-Kara", manufactured by EBARA FOODS). In each case, the amount of invention product 6 was 0.2 g to 3 g per 100 g of soup/sauce, and the obtained samples were subjected to sensory evaluation. In sensory evaluation, the samples (n = 10) were evaluated for *kokumi* (harmony, mouthfulness, body) and a mature flavor. Using each commercial product with no liquid seasoning added as control (score of 0), the results were rated on a scale of 0: absent,

1: slightly strong, 2: strong, and 3: extremely strong.

The results are shown in Tables 7 to 10.

Table 7

Effects of Addition of the Invention Product using Commercial Soba-Tsuyu as Control

Samples	Concentration (g/100 g)	Kokumi			Mature Flavor	Evaluation Comments
		Harmon y	Mouthful ness	Body		
Invention Product 6 (70 × 2)	0.2	1.6	1.5	1.4	1.5	Lack of harmony (*) in the taste of soy sauce is pleasantly suppressed
	0.5	2.1	2.0	2.3	2.2	Lack of harmony in the taste of soy sauce is pleasantly suppressed
	1.0	2.4	2.3	2.4	2.4	Mild, Lack of harmony in the taste of soy sauce is pleasantly suppressed
	3.0	3.0	2.1	2.9	2.5	Mild, Strong thick flavor, Lack of harmony in the taste of soy sauce is pleasantly suppressed

(*: "Lack of harmony" means the state where flavors and tastes are separately perceived; due to peculiar flavors and tastes being strongly perceived, undesirable flavors and tastes are resulted)

Table 8

Effects of Addition of Invention Product using Commercial Demiglace Sauce as Control

Samples	Concentration (g/100 g)	Kokumi			Mature Flavor	Evaluation Comments
		Harmon y	Mouthful ness	Body		
Invention Product 6 (70 × 2)	0.2	1.7	1.2	1.5	1.5	Thick flavor, pleasant
	0.5	2.4	2.0	2.1	2.3	Thick flavor, pleasant
	1.0	2.7	2.3	2.9	2.7	Thick flavor, pleasant
	3.0	3.0	2.4	2.9	2.7	Thick flavor, pleasant

Table 9

Effects of Addition of Invention Product using Commercial Sukiyaki Sauce as Control

Samples	Concentration (g/100 g)	Kokumi			Mature Flavor	Evaluation Comments
		Harmon y	Mouthful ness	Body		
Invention Product 6 (70 × 2)	0.2	1.6	1.3	1.4	1.5	Full of flavor, pleasant
	0.5	2.5	2.6	2.3	2.5	Mild, Thick flavor, pleasant
	1.0	2.8	2.9	3.0	2.9	Mild, Thick flavor, pleasant
	3.0	3.0	2.4	2.9	2.7	Mild, Thick flavor, pleasant

Table 10

Effects of Addition of Invention Product using Commercial Barbecue Sauce as Control

Samples	Concentration (g/100 g)	Kokumi			Mature Flavor	Evaluation Comments
		Harmon y	Mouthful ness	Body		
Invention Product 6 (70 × 2)	0.2	1.6	1.3	1.4	1.5	Lack of harmony in the taste of soy sauce is pleasantly suppressed
	0.5	2.2	1.9	2.2	2.1	Lack of harmony in the taste of soy sauce is pleasantly suppressed
	1.0	2.5	2.4	2.5	2.5	Lack of harmony in the taste of soy sauce is pleasantly suppressed
	3.0	2.9	2.2	3.0	2.5	Lack of harmony in the taste of soy sauce is pleasantly suppressed

The results of sensory evaluation shown in Tables 7 to 10 indicate that in various food products, the invention product suppresses an undesirable lack of harmony, and imparts a good balance of *kokumi* including harmony, mouthfulness, and body, thereby imparting a desired mature flavor.

(Example 8: Effects of Addition of Seasoning of the Invention at Various Concentrations to Food or Beverage)

The seasoning produced in Example 6 under preheating conditions of 70°C and 2 hours was defined as "invention product 6 (70 × 2)." The invention product 6 (70 × 2) was added to commercial *soba-tsuyu* (straight-type "Soba-Tsuyu", manufactured by YAMAKI) in amounts of 0.01 g to 20 g per 100 g of *soba-tsuyu*, and subjected to sensory evaluation (the salt content was each adjusted according to the sample having a largest amount of salt). In sensory evaluation, the samples (n = 10) were evaluated for *kokumi* (harmony, mouthfulness, body) and a mature flavor. Using *soba-tsuyu* with no liquid seasoning added as control (score of 0), the results were rated on a scale of 0: absent, 1: slightly strong, 2: strong, and 3: extremely strong.

The results are shown in Table 11.

Table 11

Effects of Addition of the Invention Product at Various Concentrations using Commercial Soba-Tsuyu as Control

Samples	Concentration (g/100 g)	Kokumi			Mature Flavor	Evaluation Comments
		Harmony	Mouthfulness	Body		
Control (With no invention product added)	-	0	0	0	0	Lack of harmony is present in the tastes of soy sauce and salt, Unpleasantly light taste
Invention product 6 (70 × 2)	0.01	0.6	0.7	0.6	0.7	Mild, Lack of harmony in the tastes of soy sauce and salt is pleasantly suppressed
	0.05	1.0	1.4	1.0	1.2	Mild, Lack of harmony in the tastes of soy sauce and salt is pleasantly suppressed
	0.1	1.5	1.7	1.5	1.6	Mild, Lack of harmony in the tastes of soy sauce and salt is pleasantly suppressed
	1	2.1	2.2	2.1	2.1	Mild, Thick flavor, Lack of harmony in the tastes of soy sauce and salt is pleasantly suppressed
	5	2.3	2.2	2.3	2.3	Mild, Strong thick flavor, Lack of harmony in the tastes of soy sauce and salt is pleasantly suppressed
	10	2.7	2.1	2.8	2.4	Mild, Strong thick flavor, Lack of harmony in the tastes of soy sauce and salt is pleasantly suppressed
	20	2.8	2.0	2.9	2.5	Mild, Strong thick flavor, Lack of harmony in the tastes of soy sauce and salt is pleasantly suppressed

(*: "Lack of harmony" means the state where flavors and tastes are separately perceived; due to peculiar

flavors and tastes being strongly perceived, undesirable flavors and tastes are resulted)

The results of sensory evaluation shown in Table 11 indicate that various concentrations of the invention product are all effective in food products.

The results also show that the seasoning can be advantageously added in an amount of 0.05% to 20% based on the food or beverage, and more advantageously in an amount of 0.1% to 5% based on the food or beverage.

Industrial Applicability

The invention makes it possible to provide a seasoning capable of imparting a strong, high-quality mature flavor to foods and beverages.

Claims

1. A method for producing a seasoning, including a step of conducting an oxidation reaction of an amino acid source and/or a peptide source and a saccharide source, the amino acid source and/or the peptide source not being a soy sauce, characterized in that:

the oxidation reaction includes a step supplying an oxygen-containing gas and/or stirring; and

the oxidation reaction is conducted at a temperature of 20°C to 50°C for a period of 0.5 hours to 48 hours.

2. A method for producing a seasoning according to claim 1, wherein the amino acid source and/or the peptide source is a yeast extract or a protein hydrolysate produced through a decolorization step and/or a deodorization step.

3. A method for producing a seasoning according to claim 1, wherein oxygen-containing gas is supplied at a supply rate of 10 ml to 300 ml of air/min per 100 g of seasoning for a supply period of 1 hour to 48 hours.

4. A method for producing a seasoning according to claim 1, wherein oxygen is supplied by stirring with a stirring power of 0.1 W to 200 W per kg of seasoning in contact with oxygen-containing gas .

5. A method for producing a seasoning according to any one of claims 1 to 4, characterized in that prior to mixing with

the saccharide source, the amino acid source and/or the peptide source is pre-heated at 50°C to 100°C for 0.5 hours to 24 hours.

6. A seasoning produced by a method according to any one of claims 1 to 5.

7. A food or beverage comprising a seasoning produced by a method according to any one of claims 1 to 5 in amount of 0.01% to 99% based on the food or beverage.

8. A mature-flavor-imparting agent produced by a method according to any one of claims 1 to 5.