

PLANT EXTRACT CONTAINING 2-ACETYL-1-PYRROLINE

TECHNICAL FIELD

[0001]

The present invention relates to a plant extract containing 2-acetyl-1-pyrroline and a method for producing the same. The present invention also relates to a composition comprising 2-acetyl-1-pyrroline and a specific edible oil. The present invention also relates to a flavor or fragrance composition comprising the aforementioned plant extract or the aforementioned composition and various products comprising the aforementioned flavor or fragrance composition. Further, the present invention relates to a method for stabilizing 2-acetyl-1-pyrroline.

BACKGROUND ART

[0002]

2-acetyl-1-pyrroline is known as an aroma component contained in an aromatic odor of grain such as rice or cooked meat (J. Agric. Food Chem., 1993, 41, 1458-1461, Non-Patent Literature 1). This compound has very characteristic popcorn-like odor and a very low threshold, and therefore attention is given to the compound as a flavor material to be used for foods and the like.

Meanwhile, it is known that 2-acetyl-1-pyrroline is a very unstable compound and is colored due to polymerization or the like (J. Agric. Food Chem., 1983, 31, 823-826, Non-Patent Literature 2). For this reason, though many methods for synthesizing 2-acetyl-1-pyrroline have been reported, there are few reports of methods for synthesis on a scale that can realize industrialization.

For example, Japanese Laid-Open Patent Publication No. 2007-153785 (Patent Literature 1) reports that a method in which 2-acetyl-1-pyrroline is obtained as a dilute solution by means of azeotropic distillation with ethanol or another solvent at the time of purification can be industrialized and that 2-acetyl-1-pyrroline can be obtained in a stable state thereby.

Further, Japanese Laid-Open Patent Publication No. 2014-73999 (Patent Literature 2) reports that, when purifying 2-acetyl-1-pyrroline by means of distillation under reduced pressure, a solvent and a receiver containing the solvent are cooled and 2-

acetyl-1-pyrroline is distilled to the receiver, thereby realizing use of not only an azeotropic solvent, but also a high boiling point solvent as a diluent solvent.

CITATION LIST

PATENT LITERATURE

[0003]

Patent Literature 1: Japanese Laid-Open Patent Publication No. 2007-153785

Patent Literature 2: Japanese Laid-Open Patent Publication No. 2014-73999

NON-PATENT LITERATURE

[0004]

Non-Patent Literature 1: J. Agric. Food Chem., 1993, 41, 1458-1461

Non-Patent Literature 2: J. Agric. Food Chem., 1983, 31, 823-826

SUMMARY OF INVENTION

TECHNICAL PROBLEM

[0005]

However, no method for stabilizing 2-acetyl-1-pyrroline for a long period of time has been known, and there have still been problems for utilizing 2-acetyl-1-pyrroline as a flavor or fragrance material.

Under such circumstances, it has been desired to provide a method in which, not only 2-acetyl-1-pyrroline is obtained on industrial scale, but also the obtained 2-acetyl-1-pyrroline is stabilized for a long period of time and the characteristic odor of 2-acetyl-1-pyrroline is maintained.

SOLUTION TO PROBLEM

[0006]

The present invention is as described below.

- [1] A method for producing a plant extract containing 2-acetyl-1-pyrroline, the method comprising: an extraction step in which a plant raw material containing 2-acetyl-1-pyrroline is extracted with one or two types of edible oils selected from the group consisting of triesters (MCTs) of a medium-chain fatty acid and glycerin and triacetin.
- [2] The method according to item [1], comprising a pretreatment step in which the plant raw material is treated by means of steam distillation, water extraction or hot water extraction prior to the extraction step.
- [3] The method according to item [1] or [2], comprising a post-treatment step in which an extract obtained in the extraction step is dehydrated and filtered.
- [4] The method according to any one of items [1] to [3], wherein the plant raw material is at least one selected from the group consisting of pandan leaf, Dadacha-mame (beans), aromatic rice and corn.
- [5] A plant extract produced by the method according to any one of items [1] to [4], comprising 1 ppb to 1000 ppm of 2-acetyl-1-pyrroline.
- [6] The plant extract according to item [5], wherein, when 2-acetyl-1-pyrroline with a concentration of 10 ppm is preserved in a dark place at 30°C for 2 months, the residual ratio of 2-acetyl-1-pyrroline is 60% or more.
- [7] A composition comprising:
 - 2-acetyl-1-pyrroline; and
 - one or two types of edible oils selected from the group consisting of triesters (MCTs) of a medium-chain fatty acid and glycerin and triacetin.
- [8] A flavor or fragrance composition comprising the plant extract according to item [5] or [6] or the composition according to item [7].
- [9] The flavor or fragrance composition according to item [8], comprising 1 ppb to 1000 ppm of 2-acetyl-1-pyrroline.
- [10] A product selected from the group consisting of beverages, foods, drugs, quasi drugs, tobaccos, perfumery and cosmetics, oral care products and feeds, the product comprising the flavor or fragrance composition according to item [8] or [9].
- [11] A method for stabilizing 2-acetyl-1-pyrroline, the method comprising mixing 2-acetyl-1-pyrroline with one or two types of edible oils selected from the group consisting of triesters (MCTs) of a medium-chain fatty acid and glycerin and triacetin.
- [12] The method according to item [11], wherein, when 2-acetyl-1-pyrroline with a concentration of 10 ppm is preserved in a dark place at 30°C for 2 months, the residual ratio of 2-acetyl-1-pyrroline is 60% or more.

ADVANTAGEOUS EFFECT OF INVENTION

[0007]

According to the present invention, 2-acetyl-1-pyrroline can be stabilized by combining it with specific edible oil(s), and accordingly, it is possible to enable the characteristic odor of 2-acetyl-1-pyrroline to last. Therefore, 2-acetyl-1-pyrroline can be suitably used as a flavor or fragrance material to be used for a variety of products.

According to one embodiment of the present invention, by extracting 2-acetyl-1-pyrroline from a plant, 2-acetyl-1-pyrroline is obtained on industrial scale by a convenient and safe method, and in addition, a flavor or fragrance material rich in natural feeling can be provided.

DESCRIPTION OF EMBODIMENTS

[0008]

Hereinafter, embodiments of the present invention will be specifically described.

[0009]

1) Method for producing plant extract containing 2-acetyl-1-pyrroline

Firstly, as one embodiment of the present invention, a method for producing a plant extract containing 2-acetyl-1-pyrroline will be described.

The method for producing a plant extract containing 2-acetyl-1-pyrroline of the present invention is characterized in that it includes an extraction step in which a plant raw material containing 2-acetyl-1-pyrroline is extracted with one or two types of edible oils selected from the group consisting of triesters (MCTs) of a medium-chain fatty acid and glycerin and triacetin.

[0010]

In the method for producing a plant extract of the present invention, 2-acetyl-1-pyrroline is extracted from a plant raw material, and for this reason, the method is excellent in safety, and 2-acetyl-1-pyrroline can be obtained on industrial scale without a complicated purification process. In addition, it is possible to provide a flavor or fragrance material rich in natural feeling. Further, in the method for producing a plant extract of the present invention, as an extraction solvent, one or two types of (either or both type of) edible oils selected from the group consisting of triesters (MCTs) of a medium-chain fatty acid and glycerin, and triacetin are used, thereby stabilizing 2-acetyl-

1-pyrroline in the obtained plant extract for a long period of time, and accordingly, the characteristic odor of 2-acetyl-1-pyrroline can be maintained.

[0011]

<Extraction step>

In this step, a plant raw material containing 2-acetyl-1-pyrroline is extracted with one or two types of edible oils selected from the group consisting of triesters (MCTs) of a medium-chain fatty acid and glycerin and triacetin.

[0012]

The plant raw material is not particularly limited as long as it contains 2-acetyl-1-pyrroline. Examples of the plant raw material include at least one selected from the group consisting of pandan leaf, Dadacha-mame (beans), aromatic rice and corn. Among them, pandan leaf is preferred because it contains a large amount of 2-acetyl-1-pyrroline.

[0013]

As an extraction solvent, one or two types of edible oils selected from the group consisting of triesters (MCTs) of a medium-chain fatty acid and glycerin and triacetin are used. These edible oils have the effect of keeping 2-acetyl-1-pyrroline in a stable state. In the present invention, by using these edible oils as the extraction solvent, 2-acetyl-1-pyrroline can be directly stabilized in the obtained plant extract.

Examples of MCTs include triesters of a medium-chain fatty acid having 5 to 12, and preferably 6 to 10 carbon atoms and glycerin. Among them, glyceryl tricaproate, glyceryl tricaprilate, glyceryl tricaprinate, a combination thereof, etc. are preferred.

The usage ratio between the edible oils and the plant raw material (based on mass) is preferably 1:1 to 1:30, more preferably 1:2 to 1:15, and even more preferably 1:3 to 1:10.

[0014]

The extraction method is not particularly limited, and the plant raw material is brought into contact with the edible oils, for example, by immersing the plant raw material or heating the plant raw material to reflux in the edible oils as the extraction solvent, thereby extracting 2-acetyl-1-pyrroline from the plant raw material. For the purpose of improving the extraction efficiency of 2-acetyl-1-pyrroline, the plant raw material may be crushed in advance. Further, the plant raw material may be used as a substrate to be fermented by bacteria, fungi or the like.

[0015]

Conditions including extraction temperature, time and pressure may be suitably determined by those skilled in the art depending on the extraction method.

When extraction is performed according to an immersion method, the extraction temperature is not particularly limited and any of a heated condition, room temperature and a cooled condition may be employed. From the viewpoint of the extraction efficiency, the extraction temperature is preferably 10 to 100°C, more preferably 25 to 90°C, and even more preferably 30 to 70°C.

The extraction time is not particularly limited and may be determined in consideration of the extraction efficiency, but usually, from the viewpoint of stability, the extraction time is preferably 0.5 to 72 hours, more preferably 1 to 24 hours, and even more preferably 1 to 12 hours.

The extraction pressure is not particularly limited and any of ordinary pressure, reduced pressure and elevated pressure may be employed. Usually, from the viewpoint of stability, ordinary pressure is preferred.

[0016]

Note that in the present invention, the same plant raw material may be subjected to extraction a plurality of times. Further, for the purpose of increasing the concentration of 2-acetyl-1-pyrroline in the plant extract, etc., the extraction solvent used for extraction of a plant raw material may be used for extraction of different plant raw materials a plurality of times.

[0017]

After the extraction operation, an extract is separated according to any method such as cooling, still standing and centrifugation, thereby obtaining a plant extract.

[0018]

<Pretreatment step>

In the present invention, for the purpose of further improving the extraction efficiency of 2-acetyl-1-pyrroline, a pretreatment step, in which the plant raw material is treated by means of steam distillation, water extraction or hot water extraction prior to the extraction step, may be carried out. Conditions including temperature, time and pressure may be suitably determined by those skilled in the art depending on the treatment method. Note that when the plant raw material is treated by means of water extraction, the temperature of water is preferably 10 to 30°C, and when the plant raw material is treated by means of hot water extraction, the temperature of water is preferably 30 to 60°C.

[0019]

When the plant raw material is pretreated by means of steam distillation, water extraction or hot water extraction, from the viewpoint of stability, the pH value of water or hot water is preferably adjusted to 5 to 9 using a buffer such as a phosphate buffer.

After the operation of steam distillation, water extraction or hot water extraction, a pretreatment extract can be separated according to any method such as cooling, still standing and centrifugation.

Note that when the pretreatment step is carried out, the aforementioned extraction step is carried out by bringing the pretreatment extract into contact with the edible oils.

[0020]

<Post-treatment step>

The plant extract containing 2-acetyl-1-pyrroline obtained in the extraction step may be directly used as a flavor or fragrance material, but is preferably subjected to a post-treatment step in which the plant extract is dehydrated and filtered. By carrying out the post-treatment step, solids unrequired in the solvent are removed and water is removed, thereby further improving stability of 2-acetyl-1-pyrroline.

[0021]

2) Plant extract containing 2-acetyl-1-pyrroline

According to the method for producing a plant extract of the present invention, a plant extract containing 2-acetyl-1-pyrroline can be obtained. The obtained plant extract may be directly used as a flavor or fragrance material, or according to need, it may be diluted with one or two types of edible oils selected from the group consisting of triesters (MCTs) of a medium-chain fatty acid and glycerin and triacetin to be used as a flavor or fragrance material. The edible oils to be used as a diluent may be the same as or different from the extraction solvent.

[0022]

In the plant extract of the present invention, the content of 2-acetyl-1-pyrroline (based on mass) is preferably 1 ppb to 1000 ppm, more preferably 0.1 to 500 ppm, and even more preferably 10 to 100 ppm.

[0023]

The plant extract of the present invention is rich in natural feeling and can be suitably used as a flavor or fragrance material for a variety of products, in particular, beverages, foods, drugs, quasi drugs, tobaccos, perfumery and cosmetics, oral care products, feeds, etc.

Further, for the plant extract of the present invention, one or two types of edible oils selected from the group consisting of triesters (MCTs) of a medium-chain fatty acid and glycerin and triacetin are used as an extraction solvent, and the edible oils are directly utilized as a carrier to keep 2-acetyl-1-pyrroline. For this reason, 2-acetyl-1-pyrroline can be stabilized.

[0024]

According to a preferred embodiment of the present invention, when 2-acetyl-1-pyrroline with a concentration (based on mass) of 10 ppm is preserved in a dark place at 30°C for 2 months, the residual ratio of 2-acetyl-1-pyrroline is 60% or more, more preferably 70% or more, and even more preferably 80% or more. Note that in this specification, the residual ratio (%) of 2-acetyl-1-pyrroline can be obtained according to the below-described formula.

$$\frac{\text{(Concentration (ppm) of 2-acetyl-1-pyrroline when preserved in a dark place at 30°C for 2 months)}}{\text{(Concentration (10 ppm) of 2-acetyl-1-pyrroline at the start of stability test)}} \times 100 (\%)$$

[0025]

3) Composition comprising 2-acetyl-1-pyrroline and edible oil(s)

The composition of the present invention is characterized in that it comprises: 2-acetyl-1-pyrroline; and one or two types of edible oils selected from the group consisting of triesters (MCTs) of a medium-chain fatty acid and glycerin and triacetin.

2-acetyl-1-pyrroline may be one extracted from a plant raw material containing 2-acetyl-1-pyrroline, or may be one obtained by means of synthesis.

In the composition of the present invention, 2-acetyl-1-pyrroline is dissolved or dispersed in one or two types of edible oils selected from the group consisting of triesters (MCTs) of a medium-chain fatty acid and glycerin and triacetin, and for this reason, 2-acetyl-1-pyrroline can be stabilized.

According to a preferred embodiment of the present invention, when 2-acetyl-1-pyrroline with a concentration of 10 ppm is preserved in a dark place at 30°C for 2 months, the residual ratio of 2-acetyl-1-pyrroline is 60% or more, more preferably 70% or more, and even more preferably 80% or more.

[0026]

4) Flavor or fragrance composition

The flavor or fragrance composition of the present invention is characterized in that it comprises the aforementioned plant extract or the aforementioned composition.

The content (based on mass) of 2-acetyl-1-pyrroline in the flavor or fragrance composition of the present invention is suitably determined depending on intended use and purpose thereof and not particularly limited, but usually, the content is preferably 0.01 ppb to 1000 ppm, more preferably 0.1 ppb to 10 ppm, and even more preferably 1 ppb to 100 ppb.

[0027]

The flavor or fragrance composition of the present invention may contain various

additives. The additives are not particularly limited, and examples thereof include an antioxidant, an antiseptic agent, an antibacterial agent, a pH adjuster, a diluent, a carrier and other additives. These additives may be used solely, or two or more of them may be used in combination.

Examples of the antioxidant include butylhydroxytoluene, butylhydroxyanisole, citric acid, glutathione, selenium, lycopene, vitamin A, vitamin E, vitamin C, etc., and also include pyrrolopyrrole derivatives, free radical scavengers obtained from extracts from plants, and enzymes having antioxidant properties such as superoxide dismutase and glutathione peroxidase.

Examples of the antiseptic agent or antibacterial agent include benzoic acid, sodium benzoate, isopropyl paraoxybenzoate, isobutyl paraoxybenzoate, ethyl paraoxybenzoate, methyl paraoxybenzoate, butyl paraoxybenzoate, propyl paraoxybenzoate, sodium sulfite, sodium hyposulfite, potassium pyrosulfite, sorbic acid, potassium sorbate, sodium dehydroacetate, Thujaplicin, *Aralia cordata* extract, *Styrax japonica* extract, *Artemisia capillaris* extract, oolong tea extract, shirako (milt) protein extract, enzymatically hydrolyzed coix extract, tea catechins, apple polyphenol, pectin digests, chitosan, lysozyme and ϵ -polylysine.

[0028]

Examples of the pH adjuster include adipic acid, citric acid, trisodium citrate, glucono delta-lactone, gluconic acid, potassium gluconate, sodium gluconate, DL-tartaric acid, L-tartaric acid, DL-potassium hydrogen tartrate, L-potassium hydrogen tartrate, DL-sodium tartrate, L-sodium tartrate, potassium carbonate (anhydrous), sodium hydrogen carbonate, sodium carbonate, carbon dioxide, lactic acid, sodium lactate, glacial acetic acid, disodium dihydrogen pyrophosphate, fumaric acid, monosodium fumarate, DL-malic acid, DL-sodium malate, phosphoric acid, dipotassium hydrogen phosphate, potassium dihydrogen phosphate, disodium hydrogen phosphate and sodium dihydrogen phosphate.

[0029]

The diluent or carrier is not particularly limited as long as the effects of the present invention are not inhibited thereby.

Examples thereof include:

sugars such as sucrose, glucose, dextrin, starches, cyclodextrin, trehalose, lactose, maltose, palatinose, xylose, starch syrup and liquid sugar;

alcohols such as ethanol, propylene glycol and glycerin;

sugar alcohols such as reduced starch syrup, reduced maltose starch syrup, sorbitol, lactitol, Palatinit, mannitol, xylitol, erythritol and maltitol; and

polysaccharides such as gum arabic, xanthan gum, carrageenan, guar gum and gellan gum.

[0030]

Examples of the other additives include a chelating agent, a flavor or fragrance, a spice extract, an edible plant extract, a fruit extract, a cold pressed oil low boiling point fraction, a publicly-known antioxidant (e.g., BHT, BHA, α -tocopherol, vitamin C, etc.), a preservative (e.g., sorbic acid, benzoic acid, shirako (milt) protein extract) and a shelf life improver (e.g., sodium acetate, glycine, glycerin fatty acid ester, lysozyme, chitosan).

[0031]

The flavor or fragrance composition of the present invention can be blended in beverages, foods, drugs, quasi drugs, tobaccos, perfumery and cosmetics, oral care products, feeds, etc., or flavor or fragrance thereof can be imparted thereto.

Examples of the beverages include carbonated drinks, fruit juice drinks, fruit juice-free drinks, vegetable drinks, favorite drinks, alcohol drinks, non-alcoholic drinks, tea beverages, herbal teas, coffee beverages, functional beverages, sugarless beverages, sports drinks, energy/nutritious drinks, dairy products, milk products, lactic fermenting beverages, yogurt drinks, milk beverages, soups and various instant drinks.

[0032]

Examples of the foods include chilled sweets, Japanese sweets, western confectioneries, desserts, ice creams, sherbets, baked sweets, bakeries, candies, chewing gums, tablet confectioneries, gummy candies, oil and fat products, margarines, coffee whiteners, cheese foods, dressings, chocolates, seasonings, miso (fermented bean paste), soy sauce, sauces, mayonnaise, processed agricultural products, noodles, processed vegetable protein products, jams, pastes, dessert sauces, pickles, canned agricultural products, fruit juices, processed fruit meat products, powdered soups, retort soups, canned soups, processed livestock products, hams, sausages, hamburgers, canned meats, processed marine products, fish meat hams, fish meat sausages, fishery paste products, canned marine products, frozen foods, retort foods, instant foods and various snack foods.

[0033]

Examples of the drugs include medicinal cosmetics, medicinal lotions, tablets, liquid-type drugs, capsule-type drugs and granular drugs.

[0034]

Examples of the quasi drugs include supplements, medicinal cosmetics, medicinal bath additives and repellents.

[0035]

Examples of the tobaccos include heated tobacco products, cigarettes, cigars,

smokeless tobaccos, pipes, Oriental pipes, hookahs and electronic cigarettes.

[0036]

Examples of the perfumery and cosmetics include fragrance products, basic skin care products, hair cosmetics, makeup cosmetics, toiletry products, bath agents, body care products, hair care products, cleaning agents, kitchen detergents, soaps, fabric softeners and air fresheners.

[0037]

Examples of the oral care products include mouth washes, tooth powders, toothpastes, liquid dentifrices, oral care gums, oral care candies and mouth sprays.

[0038]

Examples of the feeds include livestock foods, pisciculture feeds and pet feeds.

[0039]

The content (based on mass) of 2-acetyl-1-pyrroline in each of various products may be suitably determined depending on purpose and intended use thereof and is not particularly limited, but usually, the content is preferably 0.02 ppt to 20 ppb, more preferably 0.2 ppt to 2 ppb, and even more preferably 2 ppt to 200 ppt. It is preferred that the flavor or fragrance composition of the present invention is blended or flavor or fragrance thereof is imparted in a manner such that the content of 2-acetyl-1-pyrroline in each of various products becomes within the above-described range.

[0040]

5) Method for stabilizing 2-acetyl-1-pyrroline

2-acetyl-1-pyrroline is a very unstable compound, but it can be stabilized by mixing it with one or two types of edible oils selected from the group consisting of triesters (MCTs) of a medium-chain fatty acid and glycerin and triacetin.

Specifically, the present invention also includes a method for stabilizing 2-acetyl-1-pyrroline, the method comprising mixing 2-acetyl-1-pyrroline with one or two types of edible oils selected from the group consisting of triesters (MCTs) of a medium-chain fatty acid and glycerin and triacetin.

According to the method of the present invention, 2-acetyl-1-pyrroline can be stabilized for a long period of time.

[0041]

According to a preferred embodiment of the present invention, when 2-acetyl-1-pyrroline with a concentration (based on mass) of 10 ppm is preserved in a dark place at 30°C for 2 months, the residual ratio of 2-acetyl-1-pyrroline is 60% or more, preferably 70% or more, and more preferably 80% or more.

[0042]

Note that it has become clear that the residual ratio of 2-acetyl-1-pyrroline depends on the concentration of 2-acetyl-1-pyrroline at the start of preservation.

[0043]

According to a preferred embodiment of the present invention, when 2-acetyl-1-pyrroline with a concentration (based on mass) of 1 ppm is preserved in a dark place at 30°C for 2 months, the residual ratio of 2-acetyl-1-pyrroline is 60% or more, preferably 70% or more, and more preferably 80% or more.

[0044]

Further, according to a preferred embodiment of the present invention, when 2-acetyl-1-pyrroline with a concentration (based on mass) of 100 ppm is preserved in a dark place at 30°C for 2 months, the residual ratio of 2-acetyl-1-pyrroline is 60% or more, preferably 70% or more, and more preferably 80% or more.

EXAMPLES

[0045]

Hereinafter, the present invention will be described in more detail by way of examples. However, the present invention is not limited to the examples.

[0046]

[Example 1]

As a plant raw material, 10 g of pandan leaf (commercially available product) was used, and 50 g of phosphate buffer (pH 7) was added thereto. The mixture was stirred at room temperature for 1 hour, and then as an edible oil, MCT (caprylic/capric triglyceride, MCT with a ratio between C6 and C8 (carbon numbers) of 6:4) was added thereto, and extraction was carried out while stirring at room temperature for 30 minutes. The obtained oil layer was used as a plant extract, and by means of gas chromatography, it was confirmed that 2-acetyl-1-pyrroline was contained therein.

[0047]

[Test Example 1] (Sensory evaluation)

0.1 g of shrimp flavor was mixed with 100 g of powdered soup, and 100 mL of boiling water was added thereto and mixed well to prepare shrimp bisque. The plant extract obtained in Example 1 was added or not added thereto to make a comparison and evaluation. Regarding each case, sensory evaluation was made by a panel consisting of 8 persons.

[0048]

Table 1: Formulation of flavoring for product to be evaluated (based on mass)

	Blank product	Plant extract of Example 1-added product
Shrimp flavor*	100%	99.8%
Plant extract of Example 1	0%	0.2%

*“Shrimp flavor” manufactured by Takasago International Corporation
[0049]

0.1% by mass of the “blank product” shown in Table 1 or 0.1% by mass of the “plant extract of Example 1-added product” shown in Table 1 was added to 100 g of powdered soup to impart flavor, 100 mL of boiling water was added thereto and mixed well to prepare shrimp bisque, and evaluation thereof was made.

The formulation of the powdered soup is as shown in Table 2.

Table 2: Formulation of powdered soup (based on mass)

Blended materials	
Names of raw materials	Soup (%)
Refined salt	12.80
Seafood extract powder (scallop, krill)	12.80
Saccharides (sugar, lactose)	12.74
Dextrin	10.94
Tomato powder	9.60
Lactose	8.00
Vegetable extract powder (onion, carrot, celery, Welsh onion)	7.14
Powdered oil and fat	6.40
Powdered skim milk	4.80
Chicken extract powder	4.22
Maltitol	4.22
Garlic powder	0.85
Yeast extract powder	0.43
“Ematech”	0.10
Amino acids, etc.	2.75
Acidulant	0.21
Thickener	2.00
Total	100.00

[0050]

Regarding four items shown in Table 3, evaluation was made by each panelist. The “blank product” and the “plant extract of Example 1-added product” were compared to each other, and the product having an advantage got one point, and the product having no advantage got zero point. The total points obtained from the panel consisting of 8 persons are shown below.

[0051]

Table 3: Results of sensory evaluation

Evaluation items	Blank product	Plant extract of Example 1-added product
Titer	1	7
Shrimp meat is recalled	2	6
Shrimp shell is recalled	4	4
Richness of taste	1	7

[0052]

It was found that the plant extract of Example 1-added product wholly has high flavor intensity and the effect of lifting up the richness of taste. It was also found that it imparts an aromatic odor by which shrimp meat is recalled.

[0053]

[Test Example 2] (Evaluation of preservation stability 1)

The content of 2-acetyl-1-pyrroline in the case where a material obtained by extracting 2-acetyl-1-pyrroline from a plant raw material with each edible oil described in Table 5 or water was preserved in a dark place at 30°C for 2 weeks or 2 months was analyzed by using GC-NPD (gas chromatography-nitrogen phosphorus detector).

The apparatus and conditions used for analysis were as described below.

Apparatus: Agilent 7890B GC System (manufactured by Agilent Technologies, Inc.)

Conditions: sample introduction part: 200°C, sample detection part: 250°C, injection amount: 0.5 μ L, splitless mode

[0054]

Table 4: Oven conditions

Rate (°C/min)	Achieving temperature (°C)	Retention time (min)
	50	1
4	70	0
15	240	0

[0055]

The concentration (based on mass) of 2-acetyl-1-pyrroline at the start of the

preservation stability test was set to be 1 ppm or 10 ppm. The residual ratios of 2-acetyl-1-pyrroline are shown in Tables 5 and 6 below.

[0056]

Table 5: Evaluation results of preservation stability (1 ppm)

	2 weeks (%)	2 months (%)
Water	56.2	26.3
Canola	38.1	0
Safflower oil	50.3	5.2
Sunflower oil	50.6	0
Triacetin	97	95.7
MCT*	92	98
Palm oil	50.9	33.4
Beef tallow	42.3	31.8
Lard	41.9	30.3

*The same one as that used in Example 1 was used.

[0057]

Table 6: Evaluation results of preservation stability (10 ppm)

	2 weeks (%)	2 months (%)
Water	38.6	1.8
Canola	18.1	0
Safflower oil	47.9	2.1
Sunflower oil	48.6	1
Triacetin	101	100
MCT*	105	101
Palm oil	53.7	19.3
Beef tallow	30	10.5
Lard	43	24.6

*The same one as that used in Example 1 was used.

[0058]

[Test Example 3] (Evaluation of preservation stability 2)

The content of 2-acetyl-1-pyrroline in the case where 2-acetyl-1-pyrroline that was a synthesized product was mixed with each edible oil described in Table 7 and preserved in a dark place at 30°C for 2 months was analyzed by using GC-NPD (gas chromatography-nitrogen phosphorus detector). The apparatus and conditions used for analysis were the same as those described in Test Example 2.

The concentration (based on mass) of 2-acetyl-1-pyrroline at the start of the preservation stability test was set to be 100 ppm.

[0059]

Table 7: Evaluation results of preservation stability (100 ppm)

	2 weeks (%)	2 months (%)
Canola	12.9	0.1
Safflower oil	28.1	0.5
Sunflower oil	29.2	0.1
Triacetin	82	86
MCT*	95	87
Palm oil	34	12
Beef tallow	11.3	3.4
Lard	69.1	67.7

*The same one as that used in Example 1 was used.

[0060]

It became clear from the above-described results that 2-acetyl-1-pyrroline is stable in MCT and triacetin solvents.

[0061]

[Test Example 4] (Evaluation of preservation stability 3)

The content of 2-acetyl-1-pyrroline in the case where 2-acetyl-1-pyrroline that was a synthesized product was mixed with MCT (the same one as that used in Example 1 was used) or triacetin and preserved in a dark place at 30°C for a certain period of time in the range of from 4 months to 13 months was analyzed by using GC-NPD (gas chromatography-nitrogen phosphorus detector). The apparatus and conditions used for analysis were the same as those described in Test Example 2.

The concentration (based on mass) of 2-acetyl-1-pyrroline at the start of the preservation stability test was set to be 10 ppm.

[0062]

Table 8: Evaluation results of preservation stability (10 ppm)

	Residual ratio in MCT solvent (%)	Residual ratio in triacetin solvent (%)
4 months	97.69	82.32
6 months	95.90	
8 months	93.07	
9 months	89.49	
10 months	86.90	
13 months	80.36	46.02

[0063]

It became clear from the above-described results that 2-acetyl-1-pyrroline is stable in MCT solvent for one year or longer.

[0064]

[Test Example 5] (Evaluation of preservation stability 4)

The content of 2-acetyl-1-pyrroline in the case where 2-acetyl-1-pyrroline that was a synthesized product was mixed with an alcohol (ethanol, methanol or glycerin) and preserved in a dark place at 30°C for 2 weeks was analyzed by using GC-NPD (gas chromatography-nitrogen phosphorus detector). The apparatus and conditions used for analysis were the same as those described in Test Example 2. The concentration (based on mass) of 2-acetyl-1-pyrroline at the start of the preservation stability test was set to be 1 ppm, 10 ppm or 100 ppm. The residual ratios of 2-acetyl-1-pyrroline are shown in Tables 9, 10 and 11 below.

[0065]

Table 9: Evaluation results of preservation stability

1 ppm	2 weeks (%)
Ethanol	96.5
Methanol	94.7
Glycerin	99

[0066]

Table 10: Evaluation results of preservation stability

10 ppm	2 weeks (%)
Ethanol	91.3
Methanol	86.7
Glycerin	28.4

[0067]

Table 11: Evaluation results of preservation stability

100 ppm	2 weeks (%)
Ethanol	75.9
Methanol	72.7

[0068]

It became clear from the above-described results that the stability of 2-acetyl-1-pyrroline in alcohol solvents depends on the concentration of 2-acetyl-1-pyrroline, and that the preservation stability is reduced when the concentration of 2-acetyl-1-pyrroline is 100 ppm.

Alcohol solvents are easily mixed with water, and therefore it is impossible to perform dehydration treatment when water is contained. Since it became clear from the results of Test Example 2 that the stability of 2-acetyl-1-pyrroline is reduced when water is contained, it is expected that the stability of 2-acetyl-1-pyrroline is further reduced when it is preserved for a long period of time.

Further, since alcohol solvents do not separate from water, solvent extraction cannot be applied to a distillate obtained after steam distillation and an aqueous extract of a plant body. It is considered that edible oils such as MCTs have an advantage on the point that, even in the case where the pretreatment step in which the plant raw material is treated by means of steam distillation, water extraction or hot water extraction prior to the extraction step is carried out, extraction from an aqueous solution as a pretreatment liquid can be carried out.

CLAIMS

1. A method for producing a plant extract containing 2-acetyl-1-pyrroline, the method comprising:

an extraction step in which a plant raw material containing 2-acetyl-1-pyrroline is extracted with one or two types of edible oils selected from the group consisting of triesters (MCTs) of a medium-chain fatty acid and glycerin and triacetin.

2. The method according to claim 1, comprising a pretreatment step in which the plant raw material is treated by means of steam distillation, water extraction or hot water extraction prior to the extraction step.

3. The method according to claim 1 or 2, comprising a post-treatment step in which an extract obtained in the extraction step is dehydrated and filtered.

4. The method according to any one of claims 1 to 3, wherein the plant raw material is at least one selected from the group consisting of pandan leaf, Dadacha-mame (beans), aromatic rice and corn.

5. A plant extract produced by the method according to any one of claims 1 to 4, comprising 1 ppb to 1000 ppm of 2-acetyl-1-pyrroline.

6. The plant extract according to claim 5, wherein, when 2-acetyl-1-pyrroline with a concentration of 10 ppm is preserved in a dark place at 30°C for 2 months, the residual ratio of 2-acetyl-1-pyrroline is 60% or more.

7. A composition comprising:

2-acetyl-1-pyrroline; and

one or two types of edible oils selected from the group consisting of triesters (MCTs) of a medium-chain fatty acid and glycerin and triacetin.

8. A flavor or fragrance composition comprising the plant extract according to claim 5 or 6 or the composition according to claim 7.

9. The flavor or fragrance composition according to claim 8, which contains 0.01 ppb to 1000 ppm of 2-acetyl-1-pyrroline.

10. A product selected from the group consisting of beverages, foods, drugs, quasi drugs, tobaccos, perfumery and cosmetics, oral care products and feeds, the product comprising the flavor or fragrance composition according to claim 8 or 9.

11. A method for stabilizing 2-acetyl-1-pyrroline, the method comprising:

mixing 2-acetyl-1-pyrroline with one or two types of edible oils selected from the group consisting of triesters (MCTs) of a medium-chain fatty acid and glycerin and triacetin.

12. The method according to claim 11, wherein, when 2-acetyl-1-pyrroline with a concentration of 10 ppm is preserved in a dark place at 30°C for 2 months, the residual ratio of 2-acetyl-1-pyrroline is 60% or more.