

Description
Title of the Invention
COFFEE EXTRACT

5 Technical Field

[0001]

The present invention relates to a coffee extract and a method of producing the coffee extract.

10 Background Art

[0002]

A coffee extract used for producing packaged coffee beverages or the like is a highly concentrated liquid coffee extract extracted from roasted coffee beans. In general, known methods for concentrating liquid coffee extract include: thermal concentration in which the extract is heated at a predetermined temperature under reduced pressure and water is evaporated off; freeze concentration in which water is frozen and ice crystals are separated and removed; and membrane concentration using a reverse osmosis membrane (RO membrane).

[0003]

In recent years, studies for utilizing forward osmosis membrane (FO membrane) in food production have attracted attention, and various methods for concentrating a liquid using FO membrane have been disclosed (for example, Patent Literatures 1 to 4). In addition, it is disclosed that centrifugation or filtration is performed as a treatment before the concentration of liquid coffee extract (for example, Patent Literature 5).

25 Citation List
Patent Literature

[0004]

Patent Literature 1: JP 2018-038367 A

Patent Literature 2: JP 2016-150308 A

30 Patent Literature 3: JP 2021-052682 A

Patent Literature 4: JP 2021-502090 T

Patent Literature 5: WO 2006/064756

35 Summary of Invention
Technical Problem

[0005]

Under such circumstances, it is desirable to provide a novel coffee extract suitable for producing coffee beverages and a method of producing the novel coffee extract.

Solution to Problem

[0006]

The present invention provides a coffee extract as described below and a method of producing the coffee extract.

5 [1] A coffee extract including a pyrazine and a phenol,
the coffee extract having a value of $A \times \text{Brix (\%)}$ of 65 or greater, where A is a sum of a peak area ratio of the pyrazine to 0.1 ppm of borneol and a peak area ratio of the phenol to 0.1 ppm of borneol, the borneol serving as an internal standard substance, in gas chromatography measurement.

10 [2] The coffee extract according to [1], in which A is from 0.93 to 6.00 and Brix (%) is from 30 to 70.

[3] The coffee extract according to [1] or [2], in which
the pyrazine is one or more compound(s) selected from the group consisting of 2,5-dimethylpyrazine, 2,6-dimethylpyrazine, 2,3-dimethylpyrazine, 2-ethyl-6-methylpyrazine, 2-ethyl-5-methylpyrazine, 2,3,5-trimethylpyrazine, 2-ethyl-3,5-dimethylpyrazine, and 2,3-diethyl-5-methylpyrazine, and

the phenol is one or more compound(s) selected from the group consisting of guaiacol, phenol, 4-ethylguaiacol, and 4-vinylguaiacol.

[4] The coffee extract according to any one of [1] to [3], in which an amount of
20 precipitate relative to a total weight of a diluted liquid is 5.00 wt.% or less, the diluted liquid being prepared by diluting the coffee extract to a Brix (%) of 5.0 and the precipitate being produced by centrifuging the diluted liquid at a centrifugal acceleration of 1660 G for 10 minutes.

[5] The coffee extract according to any one of [1] to [4], in which the coffee extract
25 includes a concentrated liquid treated by forward osmosis concentration.

[6] The coffee extract according to [5], in which the concentrated liquid is produced by subjecting a pre-treated liquid to forward osmosis concentration, the pre-treated liquid having a turbidity of from 27.4 to 95.0 NTU and a viscosity at 23°C of from 0.40 to 1.40 mPa·s.

[7] A coffee powder or a coffee beverage including the coffee extract described in any
30 one of [1] to [6].

[8] A method of producing a coffee extract, the method including
extracting coffee from roasted beans;
pre-treating the resulting liquid coffee extract by one or more process(es) selected from the group consisting of (i) centrifugation, (ii) membrane treatment, and (iii) addition of a
35 polysaccharide-degrading enzyme, and
subjecting the resulting pre-treated liquid to forward osmosis concentration.

[9] The method according to [8], in which the pre-treated liquid has a turbidity of from 27.4 to 95.0 NTU and a viscosity at 23°C of from 0.40 to 1.40 mPa·s.

Advantageous Effects of Invention

[0007]

The present invention provides a novel coffee extract suitable for producing a coffee beverage and a method of producing the coffee extract. A preferred aspect of the present invention can provide a coffee extract with a large amount of aroma components retained. Further, the production method according to an embodiment of the present invention can suppress precipitation during preparation of the coffee extract.

Brief Description of Drawings

[0008]

FIG. 1 is a diagram (1) showing the relationship between the amount of aroma components and Brix.

FIG. 2 is a graph showing the relationship between the physical properties of a pre-treated liquid and the amount of precipitate.

FIG. 3 is a diagram (2) showing the relationship between the amount of aroma components and Brix.

Description of Embodiments

[0009]

The present invention will be described in detail below. The following embodiment is an example for explaining the present invention and is not intended to limit the present invention to only this embodiment. The present invention can be implemented as various embodiments without departing from the gist of the present invention. Note that, all publications, published patent applications, patents, and other patent documents cited in this specification are incorporated herein by reference.

[0010]

1. Coffee Extract

The present invention relates to a coffee extract. In the present specification, "coffee extract" is intended to be diluted and used for consumption, and means a product with reduced water content and increased coffee solids concentration, or means a product that has been extracted in a concentrated manner and has a high concentration of coffee solids. In an aspect of the present invention, the coffee extract includes a pyrazine and a phenol and has a value of $A \times \text{Brix (\%)} \geq 65$ or greater, where A is the sum of the ratios of peak areas of the pyrazine and the phenol to 0.1 ppm of borneol, which serves as an internal standard substance of the pyrazine and the phenol, in gas chromatography measurement. The measurement conditions for gas chromatography will be described in detail in Examples below. Note that, in the present specification, the coffee extract may be referred to as "concentrated coffee liquid" or "concentrated liquid".

[0011]

Coffee beans, which are the raw material for the coffee extract, are not limited in terms of their variety, production area, degree of roast, grind size, etc. Examples of the variety include Arabica and Robusta. Examples of the production area include Guatemala, Colombia, Kilimanjaro, the Blue Mountains, Ethiopia, Kona, Mocha, Mandheling, and Costa Rica. The degree of roast may be expressed objectively using the L value of the L*a*b* color system, but the L value is not limited. The degree of roast may be any of the eight commonly used classifications, namely, light roast, cinnamon roast, medium roast, high roast, city roast, full city roast, French roast, and Italian roast. The coffee beans may be unground, but are preferably ground using a coffee mill, a grinder, or the like in order to improve the extraction rate of aroma components. The particle size of the ground coffee is not limited. The grind size may be any commonly used grind size such as, for example, very fine grind, fine grind, medium fine grind, medium grind, and coarse grind. One type of coffee beans may be used, or a mixture of a plurality of types may be used. The coffee extraction method and the like will be described later. [0012]

In an aspect of the present invention, the pyrazine is a compound having a pyrazine backbone, and examples of the pyrazine include 2,5-dimethylpyrazine, 2,6-dimethylpyrazine, 2,3-dimethylpyrazine, 2-ethyl-6-methylpyrazine, 2-ethyl-5-methylpyrazine, 2,3,5-trimethylpyrazine, 2-ethyl-3,5-dimethylpyrazine, and 2,3-diethyl-5-methylpyrazine.

In another aspect, the pyrazine includes 2,5-dimethylpyrazine, 2,6-dimethylpyrazine, 2,3-dimethylpyrazine, 2-ethyl-6-methylpyrazine, 2-ethyl-5-methylpyrazine, 2,3,5-trimethylpyrazine, 2-ethyl-3,5-dimethylpyrazine, and 2,3-diethyl-5-methylpyrazine. [0013]

In an aspect of the present invention, the phenol is a compound having a hydroxy group on an aromatic substituent, and examples of the phenol include guaiacol, phenol, 4-ethylguaiacol, and 4-vinylguaiacol.

In another aspect, the phenol includes guaiacol, phenol, 4-ethylguaiacol, and 4-vinylguaiacol. [0014]

In an aspect of the present invention, the sum A of the peak area ratio of the pyrazine to 0.1 ppm of borneol and the peak area ratio of the phenol to 0.1 ppm of borneol (CAS Registry Number: 464-43-7), the borneol serving as an internal standard substance for the pyrazine and the phenol, in gas chromatography measurement (hereinafter also referred to as "total value A" or "A") is the total sum of the ratios of the peak areas of the pyrazine and the phenol to 0.1 ppm of borneol, which is an internal standard substance of compounds of the pyrazine and the phenol. The peak area of each compound of the pyrazine and the phenol can be expressed as a ratio to the peak area of borneol, which is an internal standard substance. That is, the peak area of each compound can be expressed as a value calculated by dividing the peak area of the compound by the peak area of borneol, which is an internal standard substance. The sum A can be calculated by adding up the peak area ratios to 0.1 ppm of borneol calculated for each compound. Note that,

in the gas chromatography measurement, an error of approximately $\pm 3\%$ is allowed. In addition, the pyrazine and the phenol described above are examples, and the coffee extract according to an aspect of the present invention may contain other pyrazine compounds and phenol compounds.
[0015]

5 In an aspect of the present invention, the total value A may be, for example, from 0.93 to 6.00, from 0.98 to 5.00, from 1.30 to 4.50, from 1.35 to 4.10, from 1.50 to 3.75, from 1.62 to 3.20, from 1.80 to 3.15, from 2.00 to 3.10, or from 2.30 to 3.10. The larger the total value A is, the more aroma components are retained in the coffee extract, and the fuller-bodied the coffee beverage is, which is preferable.

10 [0016]

In an aspect of the present invention, the Brix (%) of the coffee extract may be, for example, from 30 to 70, from 30 to 65, from 30 to 60, from 30 to 55, from 30 to 50, from 30 to 45, from 30 to 40, from 40 to 70, from 40 to 65, from 40 to 60, from 40 to 55, or from 40 to 50. When the Brix (%) is within the above range, the coffee extract is highly concentrated, which is
15 preferable from the viewpoint of storage stability and transportability. The value of Brix can be measured by a known method using a sugar refractometer or the like.

[0017]

In an aspect of the present invention, the value of $A \times \text{Brix (\%)}$ may be, for example, 65 or greater, 75 or greater, 85 or greater, 95 or greater, 100 or greater, 120 or greater, 130 or
20 greater, 140 or greater, 150 or greater, 160 or greater, 170 or greater, or 180 or greater. The upper limit of the value of $A \times \text{Brix (\%)}$ is not limited, and may be, for example, 500 or less, 450 or less, 400 or less, 350 or less, 300 or less, 250 or less, or 200 or less.

[0018]

In the coffee extract according to an aspect of the present invention, the amount of
25 precipitate relative to the total weight of a diluted liquid is 5.00 wt.% or less, the diluted liquid being prepared by diluting the coffee extract to a Brix (%) of 5.0 and the precipitate being produced by centrifuging the diluted liquid at a centrifugal acceleration of 1660 G for 10 minutes. In another aspect, the amount of precipitate can be, for example, 3.00 wt.% or less, 2.50 wt.% or less, 2.00 wt.% or less, 1.50 wt.% or less, 1.08 wt.% or less, 0.650 wt.% or less, 0.350
30 wt.% or less, or 0.150 wt.% or less. The amount of precipitate can be calculated by, for example, diluting the coffee extract to a Brix (%) of 5.0, placing 25 mL of the diluted liquid of the coffee extract in a centrifuge tube, centrifuging the diluted liquid at a centrifugal acceleration of 1660 G for 10 minutes, and measuring the wet weight of the precipitate. The amount of precipitate of the diluted liquid of the coffee extract in an aspect of the present invention is calculated by the
35 above-described method.

[0019]

The coffee extract concentrated using a forward osmosis membrane described below precipitates in the step of producing a coffee beverage, and this precipitate may cause clogging of meshes or the like in the production line. The term "clogging" as used herein is different from

fouling, which is caused by components in the coffee extract adsorbing onto a membrane surface. The term "clogging" here refers to a phenomenon in which meshes or the like in a production line are clogged with a precipitate formed during storage of the concentrated coffee liquid after concentration treatment with a forward osmosis membrane, or during mixing of the concentrated liquid with a solvent such as water while stirring to prepare a coffee beverage using the concentrated coffee liquid. Therefore, it is more preferable that the amount of coffee extract precipitate be small. Although not bound by theory, it is believed that polymer components, polysaccharides, and/or fine particles contained in the coffee extract cause the precipitate.

[0020]

In an aspect of the invention, the coffee extract includes a concentrated liquid treated by forward osmosis concentration. Forward osmosis concentration is the process of bringing solutions with different osmotic pressures into contact across a semi-permeable membrane. By allowing the solvent having the lower osmotic pressure to permeate through the semi-permeable membrane to the solution having the higher osmotic pressure, the solution having the lower osmotic pressure is concentrated. The type of forward osmosis membrane is not limited, and examples that can be used include a flat membrane and a hollow fiber membrane. These forward osmosis membranes are preferably forward osmosis membrane modules. The flat membrane-type module may be, for example, a pleated type or a spiral type, and the hollow fiber membrane-type module may be, for example, a cross type or a parallel type. A commercially available FO membrane module can be purchased and used. Examples of the commercially available product include HFFO2 (available from AQUAPORIN) and OSMOF2O (trade name) INDUSTRIAL (available from Fluid Technology Solutions).

[0021]

In an aspect of the present invention, the pre-treated liquid before treatment by forward osmosis concentration has a turbidity of from 27.4 to 95.0 NTU and a viscosity at 23°C of from 0.40 to 1.40 mPa·s. In an aspect of the present invention, the pre-treated liquid may have a turbidity of from 27.4 to 93.0 NTU, from 27.4 to 92.0 NTU, from 27.4 to 84.8 NTU, or the like. By setting the turbidity of the pre-treated liquid to be within the above range, the occurrence of precipitate of the coffee extract can be suppressed or reduced. The turbidity can be measured by the nephelometric method using a standard solution of formazin.

[0022]

In an aspect of the present invention, the pre-treated liquid before treatment by forward osmosis concentration has the above-described turbidity and may have a viscosity at 23°C of from 0.40 to 1.35 mPa·s, from 0.40 to 1.30 mPa·s, from 0.40 to 1.25 mPa·s, from 0.40 to 1.18 mPa·s, or the like. By setting the viscosity of the pre-treated liquid to be within the above range, the occurrence of precipitate of the coffee extract can be suppressed or reduced. The viscosity can be measured in accordance with JIS Z 8803 using a vibration viscometer. Note that, "suppressed" or "reduced" does not mean that there is no occurrence of precipitate, but means that the occurrence of precipitate is small as compared with the case where the turbidity and the

viscosity are out of the above-described ranges. In an aspect, "suppressed" or "reduced" may mean that the amount of precipitate of the diluted liquid of the coffee extract is in the above-mentioned range.

[0023]

5 In an aspect of the present invention, the pH of the coffee extract may be, for example, from 5.0 to 7.5, from 5.0 to 7.0, from 5.0 to 6.5, or from 5.0 to 6.0.

[0024]

The coffee extract according to an embodiment of the present invention is suitably used to provide a coffee beverage by diluting the coffee extract at any ratio depending on the level of
10 concentration of the coffee extract. Examples of the dilution factor include 2x, 3x, 4x, 5x, 6x, 7x, 8x, 9x, 10x, 12x, 15x, 20x, 30x, 40x, 50x, 60x, and 70x. In an aspect of the present invention, the coffee extract is solid (powder) or liquid. Examples of the method of solidifying the coffee extract include freeze drying and spray drying. In an aspect, the coffee extract is liquid.

[0025]

15 In addition to providing a coffee beverage, the coffee extract according to an embodiment of the present invention can be used to impart a coffee flavor to a target food or drink by being added or mixed into various foods or drinks at an appropriate amount. The amount of the coffee extract to be added or mixed can be appropriately set depending on the type of the food or drink.

Examples of the food include confections, frozen desserts, supplements, and the like.

20 Examples of confections include caramel, gummies, candies, chewing gums, cookies, biscuits, cakes, pies, snacks, crackers, Japanese confections, rice confections, bean confections, jellies, desserts, and other confections.

Examples of beverages include tea beverages, cocoa beverages, nutritional beverages, carbonated beverages, jelly drinks, sports drinks, flavored waters, fruit juice drinks, alcoholic
25 beverages, non-alcoholic beverages, beer-flavored beverages such as beer and non-alcoholic beer, and functional beverages.

[0026]

2. Coffee Beverage or Coffee Powder

The present invention also relates to a coffee powder or a coffee beverage including the
30 coffee extract described in "1. Coffee Extract" above. In the present specification, the term "coffee beverage" refers to a beverage product produced using a coffee component as a raw material. The type of the product is not limited, but mainly includes "coffee", "coffee beverage", and "coffee-containing soft drink", which are defined in "Fair Competition Rules on Labeling of Coffee Beverages, etc." approved in 1977. In addition, among beverages using a coffee
35 component as a raw material, those having a milk solids content of 3.0 mass% or greater are treated as "milk beverages" under the "Fair Competition Rules on Labeling of Drinking Milk". In spite of that, such beverages are included in the coffee beverage according to an embodiment of the present invention.

[0027]

Here, the coffee component refers to a solution containing components derived from coffee beans. Examples of the coffee component include liquid coffee extract. Another example of the coffee component is a solution made using a coffee powder, such as an instant coffee produced by drying a liquid coffee extract, and using water or warm water to adjust to an appropriate amount. In the present specification, the coffee component is preferably the coffee extract described in "1. Coffee Extract" above. Note that, the coffee beans serving as a raw material are as described in "1. Coffee Extract" above.

[0028]

A milk component (a component derived from milk) such as milk, cow's milk, or a dairy product may be added to the coffee beverage according to an aspect of the present invention. The coffee beverage to which the milk component is added is also referred to as a milk-containing coffee beverage. Such a milk component may be one or more types selected from the group consisting of milk, condensed milk, skim milk, reconstituted milk (reconstituted from whole milk powder, skim milk powder, or formula milk powder), whey concentrate, concentrated milk, cream, and plant-based milk (soy milk, almond milk, or the like). Only one type of milk component may be used, or two or more types may be used in combination. The milk component to be used may be a liquid or a powder.

[0029]

The coffee beverage in an aspect of the present invention is a coffee beverage containing caffeine. The concentration of caffeine is not limited, and examples thereof include from 10 to 110 mg/100 mL, from 15 to 100 mg/100 mL, from 20 to 95 mg/100 mL, from 25 to 90 mg/100 mL, and from 30 to 85 mg/100 mL. The amount of caffeine in the coffee beverage can be measured using high performance liquid chromatography (HPLC).

[0030]

A coffee beverage according to an aspect of the present invention is a coffee beverage that has been decaffeinated. Such coffee beverages are generally referred to as "decaffeinated coffee" or "caffeine-less coffee". In an aspect of the present invention, the caffeine concentration of the coffee beverage that has been decaffeinated may be from 0.1 to 10 mg/100 mL, from 0.2 to 8 mg/100 mL, from 0.3 to 6 mg/100 mL, or the like.

[0031]

In another aspect, the coffee beverage that has been decaffeinated may be a caffeine-containing coffee beverage from which 80% or greater, 85% or greater, 90% or greater, 91% or greater, 92% or greater, 93% or greater, 94% or greater, 95% or greater, 96% or greater, 97% or greater, 98% or greater, or 99% or greater of caffeine has been removed. In another aspect, the coffee beverage that has been decaffeinated may be prepared using coffee beans having a caffeine content of 0.5% or less, 0.4% or less, 0.3% or less, 0.2% or less, 0.1% or less, or the like.

[0032]

Examples of the method of decaffeination include an organic solvent method that extracts and removes caffeine using an organic solvent, a water extraction method that removes caffeine from a liquid extract produced by soaking coffee beans in water and then returns components other than caffeine to the coffee beans, a supercritical carbon dioxide extraction method that
5 extracts and removes caffeine using carbon dioxide in a supercritical fluid state, a method of removing caffeine using an adsorbent such as a polymer resin or activated carbon, and a method of degrading caffeine using a microorganism capable of degrading caffeine. These treatments may be carried out at any step from raw materials to producing the coffee beverage depending on the method.

10 [0033]

In an aspect of the present invention, the Brix (%) of the coffee beverage may be from 1.0 to 10, from 1.0 to 5.0, from 1.0 to 4.0, from 1.0 to 3.0, from 1.0 to 2.7, from 1.0 to 2.5, or the like.

[0034]

15 The coffee beverage may include a pH adjuster. Examples of the pH adjuster include sodium hydrogen carbonate, carbon dioxide, succinic acid, gluconic acid, citric acid, trisodium citrate, phosphoric acid, lactic acid, sodium hydroxide, and/or salts thereof. In an aspect of the present invention, the pH of the coffee beverage may be from 5.0 to 7.5, from 5.0 to 7.0, from 5.0 to 6.5, from 5.0 to 6.0, or the like.

20 [0035]

In addition, the coffee beverage may contain various additives in addition to the pH adjuster. Examples of such additives include antioxidants (sodium erythorbate and the like), emulsifiers (sucrose fatty acid esters, sorbitan fatty acid esters, polyglycerin fatty acid esters), acidulants (phosphoric acid, citric acid, malic acid, and the like), flavors, and the like.

25 [0036]

The form of the coffee beverage according to an embodiment of the present invention is not limited, and may be, for example, a form of a packaged coffee beverage in which the coffee beverage is enclosed and packaged in a container such as a can, a bottle, a paper container, or a PET bottle. The method of producing the coffee beverage will be described later. Examples of
30 the method of producing the coffee powder include a method of making the coffee extract described in "1. Coffee Extract" above into a powder by freeze-drying or spray-drying.

[0037]

3. Method of Producing Coffee Extract

The present invention also relates to a method of producing a coffee extract. The
35 production method according to an embodiment of the present invention includes extracting coffee from roasted beans, pre-treating the resulting liquid coffee extract by a method selected from (i) centrifugation, (ii) membrane treatment, or (iii) addition of a polysaccharide-degrading enzyme, and subjecting the resulting pre-treated liquid to forward osmosis concentration. The

coffee extract produced by the production method according to an embodiment of the present invention has the same characteristics as those described in "1. Coffee Extract" above.

[0038]

3-1. Extracting Coffee from Roasted Beans

The production method according to an embodiment of the present invention includes extracting coffee from roasted beans. The extraction of coffee can be carried out by a commonly known method. For example, green coffee beans are roasted according to a desired degree of roast, and the roasted beans are ground according to a desired grind size. The roasted beans are not necessarily required to be ground, but, as described above, are preferably ground from the viewpoint of more efficient extraction of aroma components. The ground of coffee beans is extracted with water having a temperature of from 0 to 100°C for approximately from 10 seconds to 30 minutes depending on the amount and the extraction method. Examples of the extraction method include the drip method (for example, paper, cloth, or the like), the siphon method, the boiling method, the jet method, and the continuous method. Note that, the coffee beans serving as a raw material are as described in "1. Coffee Extract" above.

[0039]

3-2. Pre-treating the Resulting Liquid Coffee Extract by A Method Selected from (i) Centrifugation, (ii) Membrane Treatment, or (iii) Addition of a Polysaccharide-Degrading Enzyme

The production method according to an embodiment of the present invention includes pre-treating the liquid coffee extract resulting from "3-1. Extracting Coffee from Roasted Beans" above by a method selected from (i) centrifugation, (ii) membrane treatment, or (iii) addition of a polysaccharide-degrading enzyme.

[0040]

In an aspect of the present invention, all of (i) to (iii) are performed in the pre-treatment. In another aspect, (i) and (ii) are performed in the pre-treatment. In another aspect, (i) and (iii) are performed in the pre-treatment. In another aspect, (ii) and (iii) are performed in the pre-treatment. In another aspect, (i) is performed in the pre-treatment. In another aspect, (ii) is performed in the pre-treatment. In another aspect, (iii) is performed in the pre-treatment.

Any order of performing the above (i) to (iii) can be set, but when (i) is performed, it is preferable to perform (i) first.

[0041]

(i) Centrifugation

The centrifugation can be performed using a commercially available centrifuge, and may be either a batch type or a continuous type. Examples of the centrifuge include Foodec 300 (available from Alfa Laval). The centrifugation can be performed, for example, at a centrifugal acceleration of from 1500 to 2000 G, from 1600 to 1800 G, or from 1650 to 1700 G for a duration from 1 to 30 minutes, from 5 to 20 minutes, or from 5 to 15 minutes. The centrifugation may be performed once or a plurality of times.

[0042]

(ii) Membrane Treatment

The membrane treatment can be performed using a commercially available stainless steel filter, strainer, or the like. The pore size of the mesh is, for example, from 1 to 50 μm , from 3 to 30 μm , or from 5 to 25 μm . Examples of such commercially available products include PolyPro-Klean (trade name, available from 3M). The membrane treatment may be performed once or a plurality of times.

[0043]

(iii) Addition of Polysaccharide-Degrading Enzyme

The polysaccharide-degrading enzyme that can be added include, for example, a cellulose-degrading enzyme, a hemicellulose-degrading enzyme, or a pectinase. One of these enzymes may be used alone, or a plurality of these enzymes may be used in combination. Examples of commercially available enzyme preparations include Sumizyme ACH-L (available from Shinnihon Chemicals Corporation) and Mannanase BGM "Amano" (available from Amano Enzyme Inc.). The conditions of enzyme reaction can be set as appropriate depending on the enzyme preparation to be used. The reaction temperature may be, for example, from 10 to 80°C, from 20 to 70°C, from 30 to 60°C, or from 40 to 60°C. The reaction time may be, for example, from 1 to 48 hours, from 1 to 24 hours, from 1 to 12 hours, from 1 to 6 hours, or from 1 to 3 hours. The amount of the enzyme to be added may be, for example, from 0.001 to 5 wt.%, from 0.001 to 3 wt.%, from 0.01 to 1 wt.%, from 0.01 to 0.5 wt.%, from 0.01 to 0.3 wt.%, or from 0.01 to 0.1 wt.% relative to the total weight of the liquid coffee extract. The addition of a polysaccharide-degrading enzyme may be performed once or a plurality of times. Note that, in the present specification, the polysaccharide-degrading enzyme may be abbreviated to "enzyme".

[0044]

In some aspects, the liquid coffee extract may be treated with the enzyme while being stirred in order to efficiently perform the enzyme reaction. The stirring device is not limited, and for example, a vertical stirrer, a horizontal stirrer, a magnetic stirrer, a shaker, or the like can be used.

[0045]

The pre-treated liquid subjected to the enzyme treatment is, for example, heated at a temperature from 90 to 100°C for a duration from 30 seconds to 10 minutes to deactivate the enzyme.

[0046]

The pre-treated liquid produced through the treatments (i), (ii) and/or (iii) preferably has the turbidity and viscosity described in "1. Coffee Extract" above.

[0047]

3-3. Subjecting the Resulting Pre-Treated Liquid to Forward Osmosis Concentration

The production method according to an embodiment of the present invention includes subjecting the pre-treated liquid resulting from "3-2. Pre-treating the Resulting Liquid Coffee

Extract by A Method Selected from (i) Centrifugation, (ii) Membrane Treatment, or (iii) Addition of a Polysaccharide-Degrading Enzyme" to forward osmosis concentration. The forward osmosis membrane used is as described in "1. Coffee Extract" above. For example, when a hollow fiber membrane module is used, the total membrane area of a hollow fiber bundle composed of multiple hollow fibers may be from 0.1 to 50 m², from 0.1 to 40 m², or from 0.1 to 30 m², etc.

[0048]

In the concentration of the coffee extract (pre-treated liquid) using forward osmosis membrane, the solvent of the draw solution may be, for example, tap water, ion-exchanged water, soft water, distilled water, or degassed water made by degassing the foregoing. In addition, the solute of the draw solution may be, for example, salts such as sodium chloride, potassium chloride, magnesium chloride, calcium chloride, sodium sulfate, and magnesium sulfate, sugars such as sucrose, fructose, glucose, oligosaccharides, and rare sugars. The concentration of the draw liquid may be from 0.1 to 10 mol/L, from 0.1 to 8 mol/L, from 0.1 to 6 mol/L, from 0.1 to 4 mol/L, or the like.

[0049]

The amount of water permeation during concentration of coffee extract is preferably from 0.1 to 40 kg/(m² × h), from 0.1 to 30 kg/(m² × h), from 0.1 to 20 kg/(m² × h), or from 0.1 to 10 kg/(m² × h).

[0050]

The degree of concentration can be determined using Brix (%) as an indicator. In the production method according to an aspect of the present invention, the coffee extract may be concentrated until the Brix (%) reaches, for example, from 30 to 70, from 30 to 65, from 30 to 60, from 30 to 55, from 30 to 50, from 30 to 45, from 30 to 40, from 40 to 70, from 40 to 65, from 40 to 60, from 40 to 55, or from 40 to 50.

[0051]

3-4. Other Steps

The concentrated coffee extract may be clarified by centrifugation and/or membrane treatment as necessary. The methods of centrifugation and/or membrane treatment may be the same as those described in "3-2. Pre-treating the Resulting Liquid Coffee Extract by A Method Selected from (i) Centrifugation, (ii) Membrane Treatment, or (iii) Addition of a Polysaccharide-Degrading Enzyme" above. Moreover, the produced coffee extract may be filled into a tank or the like and frozen as necessary. Commonly known methods can be used for these treatments.

[0052]

Note that, the production method according to an embodiment of the present invention does not include stripping when coffee is extracted. In addition, the production method according to an embodiment of the present invention does not include separately adding or mixing in an aroma component derived from coffee beans at the time of preparing the coffee extract.

[0053]

The present invention also relates to a method of producing a coffee beverage including mixing a solvent with the coffee extract resulting from "3. Method of Producing Coffee Extract" above. Examples of the solvent include tap water, ion-exchanged water, soft water, distilled water, and degassed water made by degassing the foregoing. In addition, the solvent may contain a milk component such as milk, condensed milk, skim milk, reconstituted milk (reconstituted from whole milk powder, skim milk powder, or formula milk powder), whey concentrate, concentrated milk, cream, or plant-based milk (soy milk, almond milk, and the like). When a milk component is contained, the mixing ratio of the coffee solids and the milk solids can be set as appropriate.

[0054]

When making the coffee beverage into a packaged beverage, the method of producing a coffee beverage according to an embodiment of the present invention includes filling a container with the coffee beverage. In addition, when making the coffee beverage into a packaged beverage, the coffee beverage is preferably sterilized before or after the coffee beverage being filled in a container to allow for long-term storage. For example, when making the coffee beverage into a canned coffee beverage, a predetermined amount of the coffee beverage is filled in a can, and, for example, heat sterilization can be performed by retort sterilization at a temperature from 120 to 125°C for a duration approximately from 5 to 20 minutes. When making the coffee beverage into a PET bottle beverage, a paper packaging beverage, or a bottled beverage, a packaged beverage can be produced by performing UHT sterilization at a temperature from 130 to 145°C for a duration approximately from 2 to 120 seconds, and then subjecting a predetermined amount to hot fill packaging or cold aseptic filling.

[0055]

Exemplary Aspects

An aspect of the invention provides a coffee extract including a pyrazine and a phenol, the coffee extract having a value of A of from 0.93 to 6.00, a value of Brix (%) of from 30 to 70, a value of $A \times \text{Brix} (\%)$ of 65 or greater, where A is the sum of the peak area ratio of the pyrazine to 0.1 ppm of borneol and the peak area ratio of the phenol to 0.1 ppm of borneol, the borneol serving as an internal standard substance for the pyrazine and the phenol, in gas chromatography measurement.

In this aspect, A may be from 1.35 to 4.10, from 1.50 to 3.75, from 1.62 to 3.20, or from 1.80 to 2.50. Brix (%) may be from 30 to 50, from 30 to 40, or from 40 to 50. Further, $A \times \text{Brix} (\%)$ may be 75 or greater, 85 or greater, or 95 or greater, and may be 300 or less, 250 or less, or 200 or less.

[0056]

An aspect of the invention provides a coffee extract including a pyrazine and a phenol,

the coffee extract having a value of $A \times \text{Brix} (\%)$ of 65 or greater, where A is the sum of the peak area ratio of the pyrazine to 0.1 ppm of borneol and the peak area ratio of the phenol to 0.1 ppm of borneol, the borneol serving as an internal standard substance for the pyrazine and the phenol, in gas chromatography measurement,

the pyrazine including 2,5-dimethylpyrazine, 2,6-dimethylpyrazine, 2,3-dimethylpyrazine, 2-ethyl-6-methylpyrazine, 2-ethyl-5-methylpyrazine, 2,3,5-trimethylpyrazine, 2-ethyl-3,5-dimethylpyrazine, and 2,3-diethyl-5-methylpyrazine, and the phenol including guaiacol, phenol, 4-ethylguaiacol, and 4-vinylguaiacol.

In this aspect, $A \times \text{Brix} (\%)$ may be 75 or greater, 85 or greater, or 95 or greater, and may be 300 or less, 250 or less, or 200 or less.

[0057]

An aspect of the invention provides

a coffee extract including a pyrazine and a phenol,

the coffee extract having a value of A of from 0.93 to 6.00, a value of Brix (%) of from 30 to 70, and a value of $A \times \text{Brix} (\%)$ of 65 or greater, where A is the sum of the peak area ratio of the pyrazine to 0.1 ppm of borneol and the peak area ratio of the phenol to 0.1 ppm of borneol, the borneol serving as an internal standard substance for the pyrazine and the phenol, in gas chromatography measurement,

the pyrazine including 2,5-dimethylpyrazine, 2,6-dimethylpyrazine, 2,3-dimethylpyrazine, 2-ethyl-6-methylpyrazine, 2-ethyl-5-methylpyrazine, 2,3,5-trimethylpyrazine, 2-ethyl-3,5-dimethylpyrazine, and 2,3-diethyl-5-methylpyrazine, and the phenol including guaiacol, phenol, 4-ethylguaiacol, and 4-vinylguaiacol.

In this aspect, A may be from 1.35 to 4.10, from 1.50 to 3.75, from 1.62 to 3.20, or from 1.80 to 2.50. Brix (%) may be from 30 to 50, from 30 to 40, or from 40 to 50. Further, $A \times \text{Brix} (\%)$ may be 75 or greater, 85 or greater, or 95 or greater, and may be 300 or less, 250 or less, or 200 or less.

[0058]

An aspect of the invention provides

a coffee extract including a pyrazine and a phenol,

the coffee extract having a value of $A \times \text{Brix} (\%)$ of 65 or greater, where A is the sum of the peak area ratio of the pyrazine to 0.1 ppm of borneol and the peak area ratio of the phenol to 0.1 ppm of borneol, borneol serving as an internal standard substance of the pyrazine and the phenol, in gas chromatography measurement, and

the coffee extract including a concentrated liquid treated using a forward osmosis membrane, the concentrated liquid being produced by treating a pre-treated liquid having a turbidity of from 27.4 to 95.0 NTU and a viscosity at 23°C of from 0.40 to 1.40 mPa·s with a forward osmosis membrane.

In this aspect, the pre-treated liquid may have a turbidity of from 27.4 to 93.0 NTU, or from 27.4 to 92.0 NTU. The pre-treated liquid may have a viscosity at 23°C of from 0.40 to 1.30 mPa·s, or from 0.40 to 1.25 mPa·s.

[0059]

5 An aspect of the invention provides
a coffee extract including a pyrazine and a phenol,
the coffee extract including a concentrated liquid treated using a forward osmosis
membrane, the concentrated liquid being produced by treating a pre-treated liquid having a
turbidity of from 27.4 to 95.0 NTU and a viscosity at 23°C of from 0.40 to 1.40 mPa·s with a
10 forward osmosis membrane.

In this aspect, the pre-treated liquid may have a turbidity of from 27.4 to 93.0 NTU, or from 27.4 to 92.0 NTU. The pre-treated liquid may have a viscosity at 23°C of from 0.40 to 1.30 mPa·s, or from 0.40 to 1.25 mPa·s.

[0060]

15 An aspect of the invention provides
a coffee beverage including a pyrazine and a phenol,
the coffee beverage having a value of Brix (%) of from 1.0 to 10, and the coffee beverage
including a coffee extract in which $A \times \text{Brix} (\%)$ is 65 or greater, where A is the sum of the peak
area ratio of the pyrazine to 0.1 ppm of borneol and the peak area ratio of the phenol to 0.1 ppm
20 of borneol, borneol serving as an internal standard substance for the pyrazine and the phenol, in
gas chromatography measurement.

In this aspect, the Brix (%) of the coffee beverage may be from 1.0 to 5.0, from 1.0 to 4.0, from 1.0 to 3.0, from 1.0 to 2.7, or from 1.0 to 2.5.

[0061]

25 An aspect of the invention provides
a coffee beverage including a pyrazine and a phenol, the coffee beverage having a pH of
from 5.0 to 7.5, and the coffee beverage including a coffee extract in which $A \times \text{Brix} (\%)$ is 65 or
greater, where A is the sum of the peak area ratio of the pyrazine to 0.1 ppm of borneol and the
peak area ratio of the phenol to 0.1 ppm of borneol, borneol serving as an internal standard
30 substance for the pyrazine and the phenol, in gas chromatography measurement.

In this aspect, the coffee beverage may have a pH of from 5.0 to 7.0, from 5.0 to 6.5, or from 5.0 to 6.0.

Examples

35 [0062]

Hereinafter, the present invention will be explained in detail with reference to Examples, but the content of the present invention is not limited to Examples.

[0063]

[Example A] Analysis of Aroma Components of Coffee Extract and Evaluation of Relationship Between Amount of Aroma Components and Brix (%)

The amounts of aroma components of various coffee extracts produced using different concentration methods were analyzed. In addition, Brix (%) was measured for each concentration method, and the relationships between the amount of aroma components and Brix (%) resulting from different concentration methods were evaluated.

[0064]

Example 1

1000 g of roasted coffee beans (variety: Brazil No2 SS, L value: 19) was ground using a coffee mill, and coffee components were extracted with 8.3 times the amount of hot water (94°C). The resulting liquid coffee extract was cooled to 5°C. Next, centrifugation was performed at a centrifugal acceleration of 1600 G for 1 minute, resulting in a pre-treated liquid. Then, the pre-treated liquid was concentrated to a Brix of approximately 40% using an FO membrane module (available from Aquaporin, model number: HFFO2), resulting in a coffee extract. The concentration conditions are listed in Table 1 below. The resulting coffee extract was frozen and thawed, and then diluted with ion-exchanged water to a Brix of 0.1%. 10 µL of borneol prepared to have a concentration of 100 ppm as an internal standard substance was added to 10 mL of the diluted coffee extract, and the mixture was stirred. The mixture was used as a sample for analysis, and 100 µL of the sample was placed in a 10 mL vial and subjected to GC/MS analysis. The GC/MS analysis conditions are listed in Table 2 below. The Brix (%) of the concentrated coffee extract was measured using a sugar refractometer RX-5000α (available from Atago Co. Ltd.). The result of analysis of aroma components was expressed as a sum A of the ratios of peak areas of the pyrazine and the phenol to 0.1 ppm of the internal standard substance borneol. Note that, the pyrazines and phenols listed in Table 3 below were the components to be analyzed, and the total value A was calculated by adding up the ratios of the peak areas of the components to 0.1 ppm of the internal standard substance borneol. The results are presented in Table 4 below and FIG. 1.

[0065]

Comparative Examples 1 to 12

The aroma components and Brix (%) of the coffee extracts were analyzed in the same manner as in Example 1 except for the method of concentrating the liquid coffee extract (or pre-treated liquid). The concentration method in each Comparative Example was thermal concentration, or freeze concentration, or membrane concentration using a reverse osmosis membrane. The results are presented in Table 4 below and FIG. 1.

[0066]

Table 1

Table 1: Concentration Conditions

Temperature	23°C
-------------	------

Solute of Draw Solution	Magnesium Chloride
Solvent	Water
Concentration of Draw Solution	1 M
Flow Rate: Draw Solution	0.4 L/min
Flow Rate: Coffee	1.8 L/min
Transmembrane Pressure	0.05 MPa

[0067]

Table 2

Table 2: GC/MS Measurement Conditions

GC Device	Agilent Technologies 7890A (available from Agilent Technologies, Inc.)
MS Detector	Agilent Technologies 5975C inert XL MSD with Triple-Axis Detector (available from Agilent Technologies, Inc.)
Pre-treatment Device	Multipurpose Sampler MPS2 for GC (available from Gerstel, Inc.)
Sample Injection Conditions	DHS Method + FEDHS Method • DHS (Dynamic Headspace) Method Incubation Temperature: 25°C Time: 3 min • FEDHS (Full Evaporation DHS) Method Incubation Temperature: 80°C Time: 35 min
Column	HP-INNOWAX (length: 60 m, internal diameter: 0.250 mm, thickness: 0.25 µm) (available from Agilent Technologies, Inc.)
- Flow rate	1.65 mL/min
- Pressure	171 kPa
- Average Linear Velocity	32.9 cm/s
- Septum Purge Flow Rate	3 mL/min
Oven	40 → 260°C (5°C/min)
MS Conditions	
- Ion Source Temperature	230°C
- Ionization Mode	EI Method
- Mode	SIM/Scan
- EM Voltage	1494 V
Post-Run	0 min

[0068]

Table 3

Table 3: Components to be Analyzed

Pyrazines	Phenols
2,5-dimethylpyrazine	Guaiacol
2,6-dimethylpyrazine	Phenol
2,3-dimethylpyrazine	4-ethylguaiacol
2-ethyl-6-methylpyrazine	4-vinylguaiacol
2-ethyl-5-methylpyrazine	
2,3,5-trimethylpyrazine	
2-ethyl-3,5-dimethylpyrazine	
2,3-diethyl-5-methylpyrazine	

5 [0069]

Table 4

Table 4: Analysis Results of Aroma Components and Brix (%)

	Pyrazine + Phenol (= [A])	Brix (%)	[A] × Brix
Example 1	2.50	40	99.99
Comparative Example 1	2.11	23	48.63
Comparative Example 2	1.89	23	43.55
Comparative Example 3	1.85	23	42.62
Comparative Example 4	1.62	29.5	47.81
Comparative Example 5	1.48	30.5	45.09
Comparative Example 6	0.87	41	35.59
Comparative Example 7	0.73	40	29.39
Comparative Example 8	0.35	39	13.54
Comparative Example 9	0.25	51	12.89
Comparative Example 10	0.69	46	31.63
Comparative Example 11	0.32	47	15.11
Comparative Example 12	0.23	55	12.71

※ The values of [A] × Brix may be different from the values calculated by multiplying the numerical values in Table 4. This is because the numerical values of "pyrazines + phenols (= [A])" listed in Table 4 are rounded to the second decimal place.

10

[0070]

As presented in Table 4, it was confirmed that the coffee extract of Example 1 had a value of A, which indicates the retention of aroma components, that is larger than those of

Comparative Examples 1 to 12, indicating that a large quantity of aroma components were retained in the coffee extract. In addition, it was found that the coffee extract of Example 1 was a highly concentrated liquid coffee extract with a large amount of aroma components retained. [0071]

5 [Example B] Evaluation of Physical Properties Due to Differences in Pre-treatment, Analysis of Aroma Components, and Evaluation of Relationship Between Amount of Aroma Components and Brix (%)

The turbidity, viscosity, and the amount of precipitate of the coffee extract diluted liquid resulting from various pre-treated liquids subjected to different pre-treatment conditions were
10 evaluated. The aroma components of each coffee extract were also analyzed, and the relationships between the amount of the aroma components and Brix (%) were evaluated. [0072]

Evaluation of Physical Properties

Coffee extracts were produced in the same manner as in Example A except that two types
15 of roasted coffee beans having different L values were used and that the pre-treatment presented in Table 5 below was performed. Examples 1 to 10 and 12 have a degree of roast with an L value of 19, and Example 11 has a degree of roast with an L value of 26. The turbidity and viscosity of the pre-treated liquid before concentration of each sample were measured. In Example 1 in which no pre-treatment was performed, the turbidity and viscosity of the liquid coffee extract
20 were measured. Turbidity was measured by the nephelometric method using a standard solution of formazin. For viscosity, the viscosity at 23°C was measured in accordance with JIS Z 8803 using a vibration viscometer SV-10A (available from A&D Co., Ltd.). In addition, after concentration using an FO membrane, each concentrated liquid was diluted to a Brix of 5.0% using ion-exchanged water, and 25 mL of the diluted liquid was added to a centrifuge tube.
25 Then, centrifugation was performed at a centrifugal acceleration of 1660 G (rotation speed: 3000 rpm) for 10 minutes using a centrifuge H-28F (available from Kokusan Co., Ltd.). After letting the product stand for 10 minutes, the supernatant was removed, and the wet weight of the precipitate remaining in the centrifuge tube was measured. The pre-treatment conditions, the physical properties of the pre-treated liquid, and the amount of precipitate are listed in Table 5
30 below. In addition, Table 5 below presents whether the example was able to be concentrated to a Brix of 40%. FIG. 2 shows the relationship between the physical properties of the pre-treated liquid and the amount of precipitate. In FIG. 2, the size of a bubble represents the amount of precipitate. That is, the larger the amount of precipitate is, the larger a bubble is, and the smaller the amount of precipitate is, the smaller a bubble is. The number in the vicinity of each bubble
35 represents the sample number. Note that, the methods of centrifugation, membrane treatment, and enzyme addition were as follows. The order of the pre-treatment was centrifugation, membrane treatment, and enzyme treatment.

[0073]

- Centrifugation

Product Name: H-9R (available from Kokusan Co., Ltd.)

Centrifugal Acceleration: 1600 G (rotational speed: 3000 rpm)

Rotation Time: 1 minute

- Membrane Treatment

5 Product Name: PolyPro-Kleant (trade name, available from 3M)

Pore Size: 1 μm (Example 5)

5 μm (Examples 2, 3, 7)

10 μm (Examples 11, 12)

25 μm (Example 9)

10 • Enzyme Addition (Examples 3, 4, 6, 7)

Product Name: Sumizyme ACH-L (available from Shinnihon Chemicals Corporation)

Amount Added: 10 g/1000 L

Reaction Temperature: 50°C

Reaction Time: 180 min (Examples 3, 4), 110 min (Examples 6, 7)

15 • Enzyme Addition (Example 10)

Product Name: Sumizyme ACH-L (available from Shinnihon Chemicals Corporation)

Amount Added: 100 g/1000 L

Reaction Temperature: Treatment under ice-cooling

Reaction Time: 180 min

20 [0074]

Table 5

Table 5: Pre-treatment Conditions and Physical Properties of Coffee Extracts

Example	1	2	3	4	5	6	7	8	9	10	11	12
Centrifugation	-	•	•	•	•	•	•	•	•	•	•	•
Membrane Treatment	-	•	•	-	•	-	•	-	•	-	•	•
Enzyme Addition	-	-	•	•	-	•	•	-	-	•	-	-
Turbidity (NTU)	85.2	54.5	27.4	84.8	41.9	76.5	47.7	80.8	70.5	91.7	57.6	28
Viscosity (mPa·s)	1.19	1.23	0.4	0.68	1.08	0.5	0.74	1.22	1.15	0.91	0.52	0.54
Whether Able to be Concentrated to Brix 40	×	○	○	○	○	○	○	○	○	○	○	○
Amount of Precipitate	-	0.03	0.01	0.025	0.02	0.02	0.02	0.27	0.035	0.03	0.015	0.02

(g)												
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※ In the table, "●" means that the corresponding treatment was performed.

※ In the table, "-" means that the corresponding treatment was not performed, or evaluation was not performed.

※ In the table, "○" means that the corresponding treatment was able to be performed, and "X"

5 means that the corresponding treatment was not able to be performed.

[0075]

As presented in Table 5, in the case of the sample of Example 1 which was not subjected to any pre-treatment, the turbidity and viscosity of the liquid coffee extract were approximately the same as those of the other samples after pre-treatment; despite of that, the surface of the FO membrane was clogged, and the sample of Example 1 was not able be concentrated to a Brix of 40%. Therefore, the amount of precipitate of the sample of Example 1 could not be measured. Meanwhile, the samples of Examples 2 to 12 which were subjected to a pre-treatment were able to be concentrated to a Brix of 40%. In addition, in the samples of Examples 2 to 12, precipitation hardly occurred during the preparation of the coffee extracts.

[0076]

Analysis of Aroma Component

The amount of aroma components and Brix (%) of the samples of Examples 2 to 12 were measured in the same manner as in Example A. The results are listed in Table 6. FIG. 3 also shows the relationship between the amount of aroma components and Brix (%).

[0077]

Table 6

Table 6: Analysis Results of Aroma Components and Brix (%)

	Pyrazine + Phenol (= [A])	Brix (%)	[A] × Brix
Example 2	2.49	40.0	99.60
Example 3	2.41	40.1	96.64
Example 4	2.51	39.8	99.70
Example 5	3.04	40.5	123.24
Example 6	2.34	41.2	96.49
Example 7	2.40	40	96.12
Example 8	2.56	39.2	100.27
Example 9	2.96	40.4	119.71
Example 10	3.09	40.5	125.31
Example 11	2.35	41	96.15
Example 12	2.75	40.2	110.67

※ The values of $[A] \times \text{Brix}$ may be different from the values calculated by multiplying the numerical values in Table 6. This is because the numerical values of "pyrazines + phenols (= $[A]$)" listed in Table 6 are rounded to the second decimal place.

5 [0078]

As presented in Table 6, it was confirmed that the coffee extracts of Examples 2 to 12 all retained a large amount of aroma components. In addition, it was found that these coffee extracts were highly concentrated liquid coffee extracts with a large amount of aroma components retained.

10 [0079]

[Example C] Sensory Evaluation of Coffee Extracts

The taste quality of each coffee extract diluted liquid was evaluated by a sensory test.

[0080]

Among the coffee extracts produced in Example A above, Example 1, Comparative Example 1, Comparative Example 6, and Comparative Example 8 were diluted with ion-exchanged water to a Brix of 1.3% and used as samples for sensory evaluation. Each sample was evaluated based on the following criteria by four expert panelists trained in sensory perception. Note that, the evaluation was performed from the viewpoint of coffee-like aroma from the middle notes to the base notes using four ratings: "◎", "○", "△", and "×". The results are listed in Table 7. In addition to the results of the sensory evaluation, Table 7 also presents the amount of aroma components (total value A), Brix (%), $A \times \text{Brix}$ (%), and the evaluation result of Brix based on the following criteria of each sample. Note that, in Table 7: Sample No. 1 corresponds to Example 1 of Example A; Sample No. 2 and Sample No. 3 are produced by mixing the sample of Example 1 and a separately prepared coffee extract (which was concentrated by a method other than forward osmosis concentration, with a Brix the same as that in Example 1 but a value of A lower than that in Example 1) and adjusting the value of $A \times \text{Brix}$ to a desired value; Sample No. 4 corresponds to Comparative Example 1 of Example A; Sample No. 5 corresponds to Comparative Example 6 of Example A; and Sample No. 6 corresponds to Comparative Example 8 of Example A.

30 [0081]

- Evaluation Criteria (Sensory Test)

◎: A coffee-like aroma is strongly felt from the middle to the base

○: A coffee-like aroma is felt from the middle to the base

△: A coffee-like aroma is slightly felt from the middle to the base

35 ×: A coffee-like aroma is not felt from the middle to the base

Note that, based on the volatility of aroma components, the aroma of coffee can be classified into three categories: the top notes, the middle notes, and the base notes. The top notes are the first aroma felt and the base notes are the remaining aroma that remains as lingering notes. The middle notes are between the top notes and the base notes and are the core aroma

components of coffee. The middle notes are called "roasted aroma", and are what give coffee its signature aroma. In the sensory evaluation, the roasted aroma of coffee felt from the middle notes to the base notes was the point of evaluation.

In addition, the evaluations given by more than half of the panelists are listed in Table 7 as the overall sensory evaluation. When two panelists gave one evaluation while the other two gave another evaluation, the higher evaluation was selected as the overall evaluation. For example, when two panelists gave the evaluation of "○" while the other two panelists gave the evaluation of "△", the overall evaluation was "○". Note that, no sample received four different evaluations (namely, "◎", "○", "△", and "×") from the four panelists. If that happens, the overall evaluation can be determined to be "○", "△", or "○/△".

[0082]

• Evaluation Criteria (Brix)

◎: Brix of 40 or greater

○: Brix of from 30 to 40

△: Brix of from 20 to 30

×: Brix of from 10 to 20

[0083]

Table 7

Table 7: Results of Sensory Evaluation and the Like

Sample No.	1	2	3	4	5	6
A × Brix	99.99	80	65	48.63	35.59	13.54
A	2.50	2	1.625	2.11	0.87	0.35
Brix	40	40	40	23	41	39
Brix Evaluation	◎	◎	◎	△	◎	○
Sensory Evaluation	◎	◎	○	×	×	×

[0084]

As presented in Table 7, in Samples Nos. 4 to 6, the amount of aroma components or Brix was insufficient, and a coffee-like aroma was not felt from the middle to the base. Meanwhile, in Samples Nos. 1 to 3, both the amount of aroma components and the Brix were at a sufficient value, and the results of the sensory test were also good. From the above results, it was found that the coffee extract having a value of A × Brix of 65 or greater was excellent for beverage production.

Claims

[Claim 1]

A coffee extract comprising a pyrazine and a phenol, wherein

5 the coffee extract has a value of $A \times \text{Brix (\%)}$ of 65 or greater, where A is a sum of a peak area ratio of the pyrazine and the phenol to 0.1 ppm of borneol as an internal standard substance in gas chromatography measurement.

[Claim 2]

10 The coffee extract according to claim 1, wherein A is from 0.93 to 6.00 and Brix (%) is from 30 to 70.

[Claim 3]

The coffee extract according to claim 1 or 2, wherein

15 the pyrazine is one or more compound(s) selected from the group consisting of 2,5-dimethylpyrazine, 2,6-dimethylpyrazine, 2,3-dimethylpyrazine, 2-ethyl-6-methylpyrazine, 2-ethyl-5-methylpyrazine, 2,3,5-trimethylpyrazine, 2-ethyl-3,5-dimethylpyrazine, and 2,3-diethyl-5-methylpyrazine, and

20 the phenol is one or more compound(s) selected from the group consisting of guaiacol, phenol, 4-ethylguaiacol, and 4-vinylguaiacol.

[Claim 4]

The coffee extract according to any one of claims 1 to 3, wherein an amount of precipitate relative to a total weight of a diluted liquid is 5.00 wt.% or less, the diluted liquid
25 being prepared by diluting the coffee extract to a Brix (%) of 5.0 and the precipitate being produced by centrifuging the diluted liquid at a centrifugal acceleration of 1660 G for 10 minutes.

[Claim 5]

30 The coffee extract according to any one of claims 1 to 4, wherein the coffee extract comprises a concentrated liquid treated by forward osmosis concentration.

[Claim 6]

35 The coffee extract according to claim 5, wherein the concentrated liquid is produced by subjecting a pre-treated liquid to forward osmosis concentration, the pre-treated liquid having a turbidity of from 27.4 to 95.0 NTU and a viscosity at 23°C of from 0.40 to 1.40 mPa·s.

[Claim 7]

A coffee powder or a coffee beverage comprising the coffee extract according to any one of claims 1 to 6.

[Claim 8]

- 5 A method of producing a coffee extract, the method comprising:
 extracting coffee from roasted beans;
 pre-treating the resulting liquid coffee extract by one or more process(es) selected from
the group consisting of (i) centrifugation, (ii) membrane treatment, and (iii) addition of a
polysaccharide-degrading enzyme; and
10 subjecting the resulting pre-treated liquid to forward osmosis concentration.

[Claim 9]

- The method according to claim 8, wherein the pre-treated liquid has a turbidity of from
27.4 to 95.0 NTU and a viscosity at 23°C of from 0.40 to 1.40 mPa·s.
15