

DESCRIPTION

METHOD FOR PRODUCING COFFEE EXTRACT

TECHNICAL FIELD

[0001] The present invention relates to, for instance, a method for producing a coffee extract. The present invention relates specifically to a method for producing a coffee extract with enhanced coffee-specific aroma and reduced miscellaneous flavor.

BACKGROUND ART

[0002] Roasting coffee beans causes chemical changes in flavor and aroma components contained in the green coffee beans, resulting in the coffee's unique taste and aroma.

However, a commonly known drip extraction process has been known to cause the main extracted components to change from the early to late stages of the coffee extraction step. For example, the coffee-specific favorable aroma components are mainly extracted in the early stage of extraction, while the miscellaneous flavor-contributing components are mainly extracted in the middle to late stages of extraction.

[0003] Various extraction processes have since been studied to obtain a favorable coffee extract. For example, Japanese Patent Laid-Open No. 2018-068122 (PTL 1), Japanese Patent Laid-Open No. 2018-068247 (PTL 2), and Japanese Patent Laid-Open No. 2018-113986 (PTL 3) each describe a method for producing a coffee extract by multi-step extraction. Unfortunately, the method of extracting a coffee extract by multi-step extraction still gives a problem of extracting miscellaneous flavor components. Meanwhile, a method using activated carbon is known as a method of removing miscellaneous flavor components (PTL 4). However, the problem is that desirable aroma components, together with the miscellaneous flavor components, are also removed at the same time. In light of such a situation, a method has been sought that provides a coffee extract with enhanced coffee-specific aroma and reduced miscellaneous flavor.

CITATION LIST

PATENT LITERATURE

[0004] PTL 1: Japanese Patent Laid-Open No. 2018-068122

PTL 2: Japanese Patent Laid-Open No. 2018-068247

PTL 3: Japanese Patent Laid-Open No. 2018-113986

PTL 4: Japanese Patent Laid-Open No. 2017-006015

SUMMARY OF INVENTION

TECHNICAL PROBLEM

[0005] The present invention addresses the problem of producing a coffee extract with enhanced coffee-specific aroma and reduced miscellaneous flavor.

SOLUTION TO PROBLEM

[0006] Coffee-specific aroma components are extracted at the early stage during an extraction process. Here, when only a coffee extract with a low extraction rate is used, the volume of coffee extract obtained from a certain amount of roasted and ground coffee beans is very small. This causes a cost problem. On the other hand, the volume of coffee extract obtained from a given amount of roasted and ground coffee beans may be increased to improve the extraction rate. In this case, miscellaneous flavor components extracted in the middle to late stages of the extraction process are also extracted in large quantities.

[0007] The present inventors have conducted intensive research and as a result, have revealed that in the first extraction step, roasted and ground coffee beans are packed in a column, water is supplied to the column packed with the roasted and ground coffee beans, and extraction is performed until the extraction rate reaches 1.0% or more and 20.0% or less; and this can produce a coffee extract with maintained coffee-specific favorable flavor. In addition, in the second extraction step after the first extraction step, extraction is performed until the extraction rate is further increased by 1.0% or more and 15.0% or less, and the miscellaneous flavor components in the resulting extract are removed by gas separation using a non-thermal procedure. This has been demonstrated to decrease miscellaneous flavor in the extract. Then, the coffee extract obtained in the first extraction step is mixed with the coffee extract from which gas has been separated after the second extraction step. This has been found to be able to produce a coffee extract with enhanced coffee-specific aroma and

reduced miscellaneous flavor. The present invention has thus been completed.

[0008] Specifically, the present invention pertains to, but is not limited to, the following items.

(1) A method for producing a coffee extract, comprising:

a) a first extraction step of supplying water to a column packed with roasted and ground coffee beans and collecting a coffee extract until an extraction rate reaches 1.0% or more and 20.0% or less, where the extraction rate is defined as a solid content concentration (Brix) of the collected coffee extract based on a weight of the roasted and ground coffee beans and is calculated using the following formula:

$$\frac{(\text{a liquid volume (kg) of the coffee extract collected in the first extraction step} \times \text{Brix (\%) of the coffee extract collected in the first extraction step})}{(\text{a weight (kg) of the roasted and ground coffee beans in the column})};$$

b) a second extraction step of collecting, after the first extraction step, a coffee extract until an extraction rate is further increased by 1.0% or more and 15.0% or less, where the extraction rate is calculated by the following formula:

$$\frac{(\text{a liquid volume (kg) of the coffee extract collected in the second extraction step} \times \text{Brix (\%) of the coffee extract collected in the second extraction step})}{(\text{a weight (kg) of the roasted and ground coffee beans in the column})};$$

c) a step of separating gas contained in the coffee extract obtained in the second extraction step using a non-thermal procedure; and

d) a step of mixing the coffee extract obtained in the first extraction step with the coffee extract from which the gas has been separated.

(2) The production method according to (1), wherein the gas separation using the non-thermal procedure in step c) is performed by membrane processing.

(3) The production method according to (1) or (2), wherein an amount of the roasted and ground coffee beans packed per L of column volume is 0.01 kg or more and 0.50 kg or less.

(4) The production method according to any one of (1) to (3), wherein the water

supplied to the column in the first extraction step has a temperature of 40°C or higher and 120°C or lower.

(5) The production method according to any one of (1) to (4), wherein water supplied to the column in the second extraction step has a temperature of 40°C or higher and 120°C or lower.

(6) A method of enhancing coffee-specific aroma and reducing miscellaneous flavor in a coffee extract, comprising:

a) a first extraction step of supplying water to a column packed with roasted and ground coffee beans and collecting a coffee extract until an extraction rate reaches 1.0% or more and 20.0% or less, where the extraction rate is defined as a solid content concentration (Brix) of the collected coffee extract based on a weight of the roasted and ground coffee beans and is calculated using the following formula:

$$\frac{(\text{a liquid volume (kg) of the coffee extract collected in the first extraction step} \times \text{Brix (\%) of the coffee extract collected in the first extraction step})}{(\text{a weight (kg) of the roasted and ground coffee beans in the column})};$$

b) a second extraction step of collecting, after the first extraction step, a coffee extract until an extraction rate is further increased by 1.0% or more and 15.0% or less, where the extraction rate is calculated by the following formula:

$$\frac{(\text{a liquid volume (kg) of the coffee extract collected in the second extraction step} \times \text{Brix (\%) of the coffee extract collected in the second extraction step})}{(\text{a weight (kg) of the roasted and ground coffee beans in the column})};$$

c) a step of separating gas contained in the coffee extract obtained in the second extraction step using a non-thermal procedure; and

d) a step of mixing the coffee extract obtained in the first extraction step with the coffee extract from which the gas has been separated.

ADVANTAGEOUS EFFECTS OF INVENTION

[0009] The present invention makes it possible to produce a coffee extract with enhanced coffee-specific aroma and reduced miscellaneous flavor.

BRIEF DESCRIPTION OF DRAWINGS

[0010] [Fig. 1] Fig. 1 shows the results of tests for sensory evaluation of coffee extract with or without gas separation.

DESCRIPTION OF EMBODIMENTS

[0011] 1. Method for Producing Coffee Extract

An embodiment of the present invention provides a method for producing a coffee extract, comprising: a) a first extraction step of supplying water to a column packed with roasted and ground coffee beans and collecting a coffee extract until an extraction rate reaches 1.0% or more and 20.0% or less; b) a second extraction step of collecting, after the first extraction step, a coffee extract until the extraction rate is further increased by 1.0% or more and 15.0% or less; c) a step of separating gas contained in the coffee extract obtained in the second extraction step using a non-thermal procedure; and d) a step of mixing the coffee extract obtained in the first extraction step with the coffee extract from which the gas has been separated. Here, the extraction rate is defined as the solid content concentration (Brix), based on the weight of the roasted and ground coffee beans, in each coffee extract collected. The extraction rate in the first extraction step is calculated by (the liquid volume (kg) of the coffee extract collected in the first extraction step $\times$ Brix (%) of the coffee extract collected in the first extraction step) / (the weight (kg) of the roasted and ground coffee beans in the column); and the extraction rate in the second extraction step is deduced by (the liquid volume (kg) of the coffee extract collected in the second extraction step $\times$ Brix (%) of the coffee extract collected in the second extraction step) / (the weight (kg) of the roasted and ground coffee beans in the column). This method makes it possible to produce a coffee extract with enhanced coffee-specific aroma and reduced miscellaneous flavor. Note that as used herein, the term "coffee-specific aroma" means the sweet aroma of freshly ground coffee. In addition, the term "miscellaneous flavor" means undesirable tastes such as a burnt smell and a chemical odor.

[0012] 1-1. Roasted and Ground Coffee Beans

As used herein, the term "roasted and ground coffee beans" means coffee beans that

have undergone the process of heating and roasting green coffee beans, i.e., the "roasting process," and have then been ground. In the present invention, the origin and variety of coffee beans used for roasted and ground coffee beans are not particularly limited.

Examples of the origin of coffee beans include Brazil, Colombia, Tanzania, Mocha, Kilimanjaro, Mandarin, or Blue Mountain. Examples of the coffee bean variety include Arabica, Robusta, or Liberica. Coffee beans may be of a single origin or a single variety, or coffee beans of different origins or varieties may be used in combination. The variety of coffee beans used in the method for producing a coffee extract according to the present invention is not particularly limited, but it is preferable to use Arabica or Robusta beans.

[0013] In the present invention, the roasting procedure and conditions for obtaining roasted coffee beans from green coffee beans are not particularly limited. It is possible to use, for instance, a direct flame, hot air, semi-hot air, charcoal, far-infrared, microwave, or superheated vapor process. A horizontal (lateral) drum type, vertical (perpendicular) drum type, vertical rotating bowl type, fluidized bed type, or pressurized type machine may be used. Coffee beans should be roasted to the desired degree (light, cinnamon, medium, high, city, full city, French, Italian) corresponding to the variety of the coffee beans.

[0014] Regarding roasted and ground coffee beans used in the present invention, the roasting temperature to obtain the roasted coffee beans is not particularly limited. The roasting temperature is preferably 100°C or higher, 110°C or higher, 120°C or higher, 130°C or higher, 140°C or higher, 150°C or higher, or 160°C or higher, and more preferably 170°C or higher. In addition, the roasting temperature is preferably 300°C or lower, 290°C or lower, 280°C or lower, 270°C or lower, 260°C or lower, 250°C or lower, 240°C or lower, or 230°C or lower, and more preferably 220°C or lower. Typically, for roasted and ground coffee beans used in the invention, the roasting temperature to obtain the roasted coffee beans ranges preferably from 100°C to 300°C, from 110°C to 280°C, from 120°C to 270°C, from 130°C to 260°C, from 140°C to 250°C, from 150°C to 240°C, or from 160°C to 230°C, and more preferably from 170°C to 220°C. The roasting time to obtain the roasted coffee beans is not particularly limited, but the roasting time is preferably 4 minutes or longer, 5 minutes

or longer, 6 minutes or longer, or 7 minutes or longer, and more preferably 8 minutes or longer. In addition, the roasting time is preferably 30 minutes or less, 25 minutes or less, 22 minutes or less, 20 minutes or less, 17 minutes or less, or 15 minutes or less, and more preferably 13 minutes or less. Typically, the roasting times to obtain the roasted coffee beans ranges preferably from 4 to 30 minutes, from 5 to 25 minutes, from 6 to 20 minutes, or from 7 to 15 minutes, and more preferably from 8 to 13 minutes. In addition, the roasting degree of roasted coffee beans is not particularly limited. The roasting degree while the L value measured with a color difference meter is used as an indicator is preferably 10 or more, 12 or more, 13 or more, or 14 or more, and more preferably 15 or more. The roasting degree is preferably 30 or less, 28 or less, 27 or less, or 26 or less, and more preferably 25 or less. Typically, the roasting degree of roasted coffee beans while the L value measured with a color difference meter is used as an indicator is from 10 to 30, from 12 to 28, from 13 to 27, or from 14 to 26, and more preferably from 15 to 25. The roasting degree is measured by injecting ground beans into a cell, tapping the cell sufficiently, and measuring the degree with a spectrophotometer. The spectrophotometer used may be, for instance, SE-2000, manufactured by NIPPON DENSHOKU INDUSTRIES Co., Ltd.

[0015] The grinding procedure to obtain roasted and ground coffee beans in the present invention is not particularly limited, and a common procedure such as dry grinding or wet grinding may be used.

[0016] 1-2. Coffee Extract

As used herein, the term "coffee extract" refers to a liquid extracted from coffee beans. Examples of the coffee extract include an extract obtained by extracting roasted coffee beans with water or another solvent, a product obtained by diluting or concentrating the extract, or a slurry containing coffee beans or ground coffee beans. In addition, the "coffee extract" may be diluted, if appropriate, and optionally mixed with other raw materials to produce a coffee beverage.

[0017] 1-3. First Extraction Step

The method for producing a coffee extract according to the present invention

includes a first extraction step of supplying water to a column packed with roasted and ground coffee beans and collecting a coffee extract until an extraction rate reaches 1.0% or more and 20.0% or less; and a second extraction step of collecting, after the first extraction step, a coffee extract until the extraction rate is further increased by 1.0% or more and 15.0% or less.

[0018] Coffee-specific favorable aroma components are obtained at the early stage during an extraction process. Thus, in order to obtain an coffee extract rich in coffee-specific aroma components, it is preferable to recover an extract while the extraction rate is in a low range. Accordingly, the method for producing a coffee extract according to the present invention includes, as the first extraction step, a step of supplying water to a column packed with roasted and ground coffee beans and collecting a coffee extract until an extraction rate reaches 1.0% or more and 20.0% or less.

[0019] The temperature of the water supplied in the first extraction step is preferably 40°C or higher, 45°C or higher, 50°C or higher, 55°C or higher, 60°C or higher, or 65°C or higher, and more preferably 70°C or higher. In addition, the temperature of the water supplied in the first extraction step is preferably 120°C or lower, 116°C or lower, 112°C or lower, 108°C or lower, 106°C or lower, or 104°C or lower, and more preferably 100°C or lower.

Typically, the temperature of the water supplied in the extraction step ranges preferably from 40°C to 120°C, from 45°C to 116°C, from 50°C to 112°C, from 55°C to 108°C, from 60°C to 106°C, or from 65°C to 104°C, and more preferably from 70°C to 100°C.

[0020] Meanwhile, the extraction rate in the first extraction step is preferably 3.0% or more, 5.0% or more, 7.0% or more, 7.5% or more, 8.0% or more, 8.5% or more, 9.0% or more, or 9.5% or more, and more preferably 10.0% or more. In addition, the extraction rate in the first extraction step is preferably 18.5% or less, 18.0% or less, 17.5% or less, 17.0% or less, 16.5% or less, 16.0% or less, or 15.5% or less, and more preferably 15.0% or less.

Typically, the extraction rate in the first extraction step ranges from 1.0% to 20.0%, from 3.0% to 20.0%, from 5.0% to 20.0%, from 7.0% to 20.0%, from 7.5% to 18.0%, from 8.0% to 17.0%, from 8.5% to 16.5%, from 9.0% to 16.0%, or from 9.5% to 15.5%, and more

preferably from 10.0% to 15.0%.

[0021] Here, the extraction rate is defined as the solid content concentration (Brix), based on the weight of the roasted and ground coffee beans, in each coffee extract collected. The extraction rate in the first extraction step is calculated by (the liquid volume (kg) of the coffee extract collected in the first extraction step $\times$ Brix (%) of the coffee extract collected in the first extraction step) / (the weight (kg) of the roasted and ground coffee beans in the column).

[0022] In addition, the amount of roasted and ground coffee beans to be packed into an extraction column is also not particularly limited. The weight of roasted and ground coffee beans packed per L of column volume is preferably 0.01 kg or more, 0.05 kg or more, 0.06 kg or more, 0.07 kg or more, or 0.08 kg or more, and more preferably 0.09 kg or more. The weight of roasted and ground coffee beans packed per L of column volume is preferably 0.50 kg or less, 0.40 kg or less, or 0.30 kg or less, and more preferably 0.20 kg or less. Typically, the weight of roasted ground coffee beans to be packed, per L of column volume, in the extraction column ranges preferably from 0.01 kg to 0.50 kg (from 0.01 kg/L to 0.50 kg/L), from 0.05 kg/L to 0.50 kg/L, from 0.065 kg/L to 0.40 kg/L, or from 0.08 kg/L to 0.30 kg/L, and more preferably from 0.09 kg/L to 0.20 kg/L.

[0023] The volume of coffee extract collected from the extraction column is not particularly limited as long as the extraction is performed to have a given extraction rate. The volume of coffee extract collected from the extraction column is preferably, per kg of raw material, 0.1 kg or more, 0.3 kg or more, 0.5 kg or more, or 0.6 kg or more, and more preferably 0.75 kg or more per kg of raw material. The volume of coffee extract collected from the extraction column is preferably, per kg of raw material, 15 kg or less, 12 kg or less, 10 kg or less, 8 kg or less, or 6 kg or less, and more preferably 5 kg or less per kg of raw material. Typically, the volume of coffee extract collected from the extraction column ranges preferably from 0.1 kg to 15 kg, from 0.3 kg to 12 kg, from 0.5 kg to 10 kg, or from 0.6 kg to 6 kg per kg of raw material, and more preferably from 0.75 kg to 5 kg per kg of raw material.

[0024] In the first extraction step of the coffee extract production method of the present invention, the rate of supplying water (kg) per kg of roasted and ground coffee beans packed

is not particularly limited. It is preferable to supply water at a flow rate of 1 kg/h or more, 2 kg/h or more, 3 kg/h or more, 4 kg/h or more, or 5 kg/h or more per kg of roasted and ground coffee beans. It is also preferable to supply water at a flow rate of 80 kg/h or less, 70 kg/h or less, 60 kg/h or less, 50 kg/h or less, or 40 kg/h or less. Typically, in the first extraction step of the coffee extract production method of the present invention, the rate of supplying water per kg of roasted and ground coffee beans packed is preferably from 1 kg/h to 80 kg/h, from 2 kg/h to 70 kg/h, from 3 kg/h to 60 kg/h, from 4 kg/h to 50 kg/h, or from 5 kg/h to 40 kg/h. Note that as used herein, for example, the wording "supplying water at a flow rate of 1 kg/h per kg of roasted and ground coffee beans" means supplying 5 kg of water per hour to the column when the weight of roasted and ground coffee beans used is 5 kg.

[0025] In addition, the coffee solid content concentration of the coffee extract obtained in the first extraction step of the coffee extract production method of the present invention is, though not particularly limited, preferably 0.5% or more, 0.75% or more, 1.0% or more, 1.25% or more, 1.5% or more, 1.75% or more, or 2.0% or more, and preferably 20% or less, 17.5% or less, 15% or less, 12.5% or less, 10% or less, or 7.5% or less, in terms of Brix value. Typically, the coffee solid content concentration of the coffee extract obtained in the first extraction step of the coffee extract production method of the present invention ranges preferably from 0.5% to 20%, from 1.0% to 17.5%, from 1.25% to 15%, from 1.5% to 12.5%, from 1.75% to 10%, or from 2.0% to 7.5%, in terms of Brix value.

[0026] Note that the Brix value is a refractive index measured at 20°C by using a saccharimeter or refractometer in terms of a sucrose solution in mass/mass percent based on the conversion table of ICUMSA (International Commission for Uniform Methods of Sugar Analysis). The value indicates the soluble solid content in a beverage. The value may be represented in "Bx", "%", or "degree". A lower Brix value of beverage means a lower soluble solid content in the beverage, which content includes sugars.

[0027] 1-4. Second Extraction Step

The second extraction step in the coffee extract production method of the present invention includes a step of collecting, after the first extraction step, a coffee extract until the

extraction rate is further increased by 1.0% or more and 15.0% or less.

[0028] The temperature of water supplied in the second extraction step is preferably 40°C or higher, 45°C or higher, 50°C or higher, 55°C or higher, 60°C or higher, or 65°C or higher, and more preferably 70°C or higher. In addition, the temperature of water supplied in the second extraction step is preferably 120°C or lower, 116°C or lower, 112°C or lower, 108°C or lower, 106°C or lower, or 104°C or lower, and more preferably 100°C or lower.

Typically, the temperature of water supplied in the second extraction step ranges preferably from 40°C to 120°C, from 45°C to 116°C, from 50°C to 112°C, from 55°C to 108°C, from 60°C to 106°C, or from 65°C to 104°C, and more preferably from 70°C to 100°C.

[0029] Meanwhile, in the second extraction step, the coffee extract is preferably collected until the extraction rate of the coffee extract is further increased by 3.0% or more, 5.0% or more, 5.5% or more, 6.0% or more, 6.5% or more, 7.0% or more, or 7.5% or more. In addition, in the second extraction step, the coffee extract is preferably collected until the extraction rate of the coffee extract is further increased by 14.5% or less, 14.0% or less, 13.5% or less, 13.0% or less, or 12.5% or less. Typically, in the second extraction step, the coffee extract should be collected until the extraction rate of the coffee extract is further increased by 1.0% to 15.0%, 3.0% to 15.0%, 5.0% to 15.0%, 5.5% to 14.5%, 6.0% to 14.0%, 6.5% to 13.5%, 7.0% to 13.0%, or 7.5% to 12.5%.

[0030] Here, the extraction rate is defined as the solid content concentration (Brix), based on the weight of the roasted and ground coffee beans, in each coffee extract collected. The extraction rate in the second extraction step is calculated by (the liquid volume (kg) of the coffee extract collected in the second extraction step × Brix (%) of the coffee extract collected in the second extraction step) / (the weight (kg) of the roasted and ground coffee beans in the column).

[0031] Meanwhile, the volume of coffee extract collected from the extraction column is not particularly limited as long as the extraction is performed to have a given extraction rate. The volume of coffee extract collected from the extraction column is preferably, per kg of raw material, 0.5 kg or more, 1.0 kg or more, 1.5 kg or more, 2.0 kg or more, or 2.5 kg or

more, and more preferably 3.0 kg or more per kg of raw material. The volume of coffee extract collected from the extraction column is preferably, per kg of raw material, 15 kg or less, 13.5 kg or less, 12 kg or less, 11 kg or less, or 10 kg or less, and more preferably 9.0 kg or less per kg of raw material. Typically, the volume of coffee extract collected from the extraction column is preferably from 0.5 kg to 15 kg, from 1.0 kg to 13.5 kg, from 1.5 kg to 12 kg, from 2.0 kg to 11 kg, or from 2.5 kg to 10 kg, and more preferably from 3.0 kg to 9.0 kg per kg of raw material.

[0032] In the second extraction step of the coffee extract production method of the present invention, the rate of supplying water per kg of roasted and ground coffee beans packed is not particularly limited. It is preferable to supply water at a flow rate of 1 kg/h or more, 2 kg/h or more, 3 kg/h or more, 4 kg/h or more, or 5 kg/h or more per kg of roasted and ground coffee beans. It is also preferable to supply water at a flow rate of 80 kg/h or less, 70 kg/h or less, 60 kg/h or less, 50 kg/h or less, or 40 kg/h or less. Typically, in the second extraction step of the coffee extract production method of the present invention, the rate of supplying water per kg of roasted and ground coffee beans packed is preferably from 1 kg/h to 80 kg/h, from 2 kg/h to 70 kg/h, from 3 kg/h to 60 kg/h, from 4 kg/h to 50 kg/h, or from 5 kg/h to 40 kg/h.

[0033] In addition, the coffee solid content concentration of the coffee extract obtained in the second extraction step of the coffee extract production method of the present invention is, though not particularly limited, preferably 0.05% or more, 0.10% or more, 0.15% or more, 0.20% or more, 0.25% or more, 0.30% or more, 0.35% or more, 0.40% or more, 0.45% or more, or 0.50% or more, and preferably 9.0% or less, 7.0% or less, 6.0% or less, 5.0% or less, 4.5% or less, 4.0% or less, 3.5% or less, or 3.0% or less, in terms of Brix value. Typically, the coffee solid content concentration of the coffee extract obtained in the first extraction step of the coffee extract production method of the present invention ranges preferably from 0.05% to 9.0%, from 0.10% to 7.0%, from 0.20% to 6.0%, from 0.30% to 5.0%, from 0.40% to 4.0%, or from 0.50% to 3.0%, in terms of Brix value.

[0034] 1-5. Gas Separation Step

The method for producing a coffee extract according to the present invention includes, after the second extraction step, a step of separating gas contained in the coffee extract obtained in the second extraction step using a non-thermal procedure.

[0035] As described above, coffee-specific aroma components are extracted at the early stage during an extraction process. Here, when only a coffee extract with a low extraction rate is used, the volume of coffee extract obtained from a certain amount of roasted and ground coffee beans is very small. This causes a cost problem. On the other hand, the volume of coffee extract obtained from a given amount of roasted and ground coffee beans may be increased to improve the extraction rate. In this case, miscellaneous flavor components extracted in the middle to late stages of the extraction process are also extracted in large quantities. In other words, the first extraction step, in which a coffee extract with an extraction rate of 1.0% to 20.0% is collected, yields a coffee extract rich in coffee-specific aroma components. On the other hand, the second extraction step, in which collection is executed after the first extraction step until the extraction rate is further increased by 1.0% to 15.0%, yields a coffee extract containing a certain amount of miscellaneous flavor components. Thus, the method for producing a coffee extract according to the present invention includes a step of separating gas contained in the coffee extract after the second extraction step using a non-thermal procedure. This can remove miscellaneous flavor components in the coffee extract after the second extraction step.

[0036] The gas separation process using a non-thermal procedure is not particularly limited as long as easily vaporized components can be removed from the coffee extract. Examples of the process that can be used include a pervaporation process or a membrane separation process. The pervaporation process is also known as a permeation vaporization process or a permeation evaporation process. Specifically, the process includes disposing, on one side of a membrane, a liquid to be separated, and evacuating the opposite side to selectively remove a vaporized component that has permeated the membrane. In addition, the membrane separation process is a process for selectively separating gas using a membrane through which only vaporized components can permeate. Examples of a membrane used in the gas

separation include a hollow-fiber membrane.

[0037] In one embodiment of the present invention, gas can be separated after the second extraction step by Liqui-Cel processing. Liqui-Cel is a separation membrane module in which a porous hollow-fiber membrane is employed to remove gas from liquid. Gas separation conditions using Liqui-Cel are not particularly limited as long as miscellaneous flavor components in a coffee extract can be removed. For example, gas can be separated under the following conditions.

<Liqui-Cel Processing Conditions>

Device: 3M™ Liqui-Cel™ MM-1.7×8.75 (manufactured by 3M)

Number of modules used: 1 module

Volume of extract processed: 1.5 kg

Processing time: 30 min

Pump: 250 ml/min

Temperature: room temperature (approx. 20°C)

Nitrogen flow rate: 3 L/min

Degree of vacuum: -0.091 MPa

[0038] In the coffee extract production method of the present invention, the solid content concentration of the coffee extract is not different between before and after gas separation. The solid content concentration of the coffee extract after separation of gas after the second extraction step is, though not particularly limited, preferably 0.05% or more, 0.10% or more, 0.15% or more, 0.20% or more, 0.25% or more, 0.30% or more, 0.35% or more, 0.40% or more, 0.45% or more, or 0.50% or more, and preferably 9.0% or less, 7.0% or less, 6.0% or less, 5.0% or less, 4.5% or less, 4.0% or less, 3.5% or less, or 3.0% or less, in terms of Brix value. Typically, the coffee solid content concentration of the coffee extract after separation of gas after the second extraction step ranges preferably from 0.05% to 9.0%, from 0.10% to 7.0%, from 0.20% to 6.0%, from 0.30% to 5.0%, from 0.40% to 4.0%, or from 0.50% to 3.0%, in terms of Brix value.

[0039] 1-6. Mixing Step

The method for producing a coffee extract according to the present invention includes a step of mixing the coffee extract obtained in the first extraction step with the coffee extract, from which the gas has been separated after the second extraction step. As described above, the first extraction step, in which a coffee extract is collected until the extraction rate reaches 1.0% or more and 20.0% or less, yields a coffee extract rich in coffee-specific aroma components. Here, after the first extraction step, a coffee extract is collected until the extraction rate is further increased by 1.0% or more and 15.0% or less. In this second extraction step, a coffee extract containing a certain amount of miscellaneous flavor components is obtained. Then, gas is separated from such a coffee extract. This makes it possible to yield a coffee extract from which the miscellaneous flavor components have been removed. Then, the coffee extract obtained in the first extraction step is mixed with the coffee extract from which gas has been separated after the second extraction step. This allows for production of a coffee extract with enhanced coffee-specific aroma and reduced miscellaneous flavor.

[0040] In the method for producing a coffee extract according to the present invention, the mixing ratio between the coffee extract obtained in the first extraction step and the coffee extract from which gas has been separated after the second extraction step is not particularly limited. The coffee extract obtained in the first extraction step should be mixed, if appropriate, with the coffee extract from which gas has been separated after the second extraction step, so as to give a desired Brix value of the resulting mixed coffee extract. In the method for producing a coffee extract according to the present invention, the concentration of the coffee extract obtained by mixing the coffee extract obtained in the first extraction step with the coffee extract from which gas has been separated after the second extraction step, is preferably 0.5% or more, 0.75% or more, 1.0% or more, 1.25% or more, 1.5% or more, 1.75% or more, or 2.0% or more, and preferably 10% or less, 9.0% or less, 8.0% or less, 7.0% or less, 6.0% or less, 5.0% or less, or 4.0% or less, in terms of Brix value. In the method for producing a coffee extract according to the present invention, the concentration of the coffee extract obtained by mixing the coffee extract obtained in the first

extraction step with the coffee extract from which gas has been separated after the second extraction step, typically ranges preferably from 0.5% to 10%, from 1.0% to 9.0%, from 1.25% to 8.0%, from 1.50% to 7.0%, from 1.75% to 6.0%, or from 2.0% to 4.0%, in terms of Brix value.

[0041] 1-7. Other Matters

The coffee extract production method of the present invention may also include a heat sterilization step. In the case of including a heat sterilization step in the coffee extract production method of the present invention, the heat sterilization process is not particularly limited, and any known process such as FP sterilization or UHT sterilization may be used. For example, the coffee extract itself or its diluted liquid may be heat sterilized and then packed in a container, or the coffee extract or its diluted liquid may be packed in a container and then heat sterilized. These processes may be used to produce a heat-sterilized coffee extract or diluted liquid thereof.

[0042] In addition, the coffee extract production method of the present invention may also optionally include a freezing step.

[0043] 1-8. Coffee Beverage, etc.

One embodiment of the present invention provides a coffee extract produced by the above-described coffee extract production method. The above production method may be used to produce a coffee extract with enhanced coffee-specific aroma and reduced miscellaneous flavor.

[0044] Further, one embodiment of the present invention is a coffee beverage using a coffee extract produced by the above-described coffee extract production method. Meanwhile, the coffee beverage may be blended, if appropriate, with milk, sugars, a sweetener, or other commonly used additive(s).

[0045] Furthermore, one embodiment may provide a containerized coffee beverage packed in a given container. In the present invention, the container into which the coffee beverage is filled may be selected, if appropriate, according to the sterilization or storage process. It is possible to use any of commonly used containers such as aluminum cans, steel cans, PET

bottles, glass bottles, or paper containers. When the coffee beverage according to this embodiment is containerized, either a hot pack filling process or an aseptic filling process may be used. However, the hot pack filling process may be preferably used.

[0046] 2. Method of Enhancing Coffee-Specific Aroma and Reducing Miscellaneous Flavor in Coffee Extract.

The present invention provides a method of enhancing coffee-specific aroma and reducing miscellaneous flavor in a coffee extract, the method including:

a) a first extraction step of supplying water to a column packed with roasted and ground coffee beans and collecting a coffee extract until an extraction rate reaches 1.0% or more and 20.0% or less, where the extraction rate is defined as a solid content concentration (Brix) of the collected coffee extract based on a weight of the roasted and ground coffee beans and is calculated using the following formula:

$$\frac{(\text{a liquid volume (kg) of the coffee extract collected in the first extraction step} \times \text{Brix (\%) of the coffee extract collected in the first extraction step})}{(\text{a weight (kg) of the roasted and ground coffee beans in the column})};$$

b) a second extraction step of collecting, after the first extraction step, a coffee extract until an extraction rate is further increased by 1.0% or more and 15.0% or less, where the extraction rate is calculated by the following formula:

$$\frac{(\text{a liquid volume (kg) of the coffee extract collected in the second extraction step} \times \text{Brix (\%) of the coffee extract collected in the second extraction step})}{(\text{a weight (kg) of the roasted and ground coffee beans in the column})};$$

c) a step of separating gas contained in the coffee extract obtained in the second extraction step using a non-thermal procedure; and

d) a step of mixing the coffee extract obtained in the first extraction step with the coffee extract from which the gas has been separated. This method makes it possible to enhance coffee-specific aroma and reduce miscellaneous flavor in a coffee extract. In the method of enhancing coffee-specific aroma and reducing miscellaneous flavor in a coffee extract, the roasted and ground coffee beans, the first extraction step, the second extraction

step, the gas separation step, and the mixing step are as described in the section "1. Method for Producing Coffee Extract".

EXAMPLES

[0047] Hereinbelow, the present invention will be described in more detail with reference to Examples. However, the present invention is not limited to them.

[0048] Example 1: Production of Coffee Extract

(1) To Produce Roasted and Ground Coffee Beans

Green coffee beans (Brazilian, No.2 SS) were roasted in a coffee roasting machine to give an L value of 20. The roasted coffee beans were then ground with a grinder to prepare roasted and ground coffee beans.

[0049] (2) To Produce Coffee Extract

(i) First and Second Extraction Steps

An extraction column (column volume: 10 L) was filled with the roasted and ground coffee beans produced in (1) above at a weight of the beans of 1.0 kg/column, and then water at 94°C was supplied to the column until 9 kg of extract was collected. After the water was supplied to the column, each 1 kg of the resulting extract was collected, and the Brix value of each fraction was measured to calculate the extraction rate based on the following formula:

$$(\text{Volume of liquid collected (kg)} \times \text{Brix (\%)}) / (\text{Weight of roasted coffee beans (kg)})$$

[0050] Table 1 below shows the Brix value, the extraction rate, and the cumulative extraction rate of each fraction.

[Table 1]

Fraction	Volume of liquid collected (kg)	Cumulative volume of liquid collected (kg)	Brix value (%)	Extraction rate (%)	Cumulative extraction rate (%)
1	1	1	5.37	5.37	5.37
2	1	2	5.01	5.01	10.38
3	1	3	4.09	4.09	14.47
4	1	4	3.22	3.22	17.69
5	1	5	2.00	2.00	19.69
6	1	6	1.52	1.52	21.21
7	1	7	1.20	1.20	22.41
8	1	8	1.19	1.19	23.60
9	1	9	1.20	1.20	24.80

[0051] Of the fractions obtained, the first 1 to 3 fractions were of good quality and had little miscellaneous flavor. Thus, the miscellaneous flavor was not removed by Liqui-Cel, but the latter 4 to 9 fractions were subjected to Liqui-Cel processing to check whether the miscellaneous flavor could be reduced. The Liqui-Cel processing conditions are as follows.

[0052] <Liqui-Cel Processing Conditions>

Apparatus: 3M™ Liqui-Cel™ (manufactured by 3M)

Number of modules used: 1 module

Volume of extract processed: 1.5 kg

Processing time: 30 min

Extract feed pump: 250 ml/min

Temperature: room temperature (approx. 20°C)

Nitrogen flow rate: 3 L/min

Degree of vacuum: -0.091 MPa

[0053] Next, coffee extracts from the first three fractions were mixed with coffee extracts from the Liqui-Cel-processed latter six fractions at a ratio of 1:2. Specifically, the extracts were mixed so that the rate obtained by multiplying the Brix value of each extract by the mixing volume was equal to the extraction rate (%) of each extract. That is, the cumulative extraction rate and the Brix value of the first three fractions are 14.47% and 4.82%, respectively, and those of the Liqui-Cel-processed latter six fractions are 10.33% and 1.72%,

respectively. Thus, the mixing ratio between the first three fractions and the Liqui-Cel-processed latter six fractions is 1:2. After the two were mixed, the Brix value of each sample was adjusted to 1.3, and the sample was sterilized at 115°C for 5 min, followed by sensory evaluation.

[0054] Example 2: Sensory Evaluation of Coffee Extract

The coffee extracts of the first 1 to 3 fractions and the coffee extracts of the Liqui-Cel-processed latter 4 to 9 fractions as produced in Example 1 described above were mixed to prepare a coffee extract of Example 1. In addition, the coffee extracts of the first 1 to 3 fractions and the coffee extracts of the latter 4 to 9 fractions before the Liqui-Cel processing were mixed to prepare a coffee extract of Comparative Example 1. Then, Example 1 and Comparative Example 1 were subject to sensory evaluation by (five) expert panelists. In the sensory evaluation, expert panelists drank approximately 50 mL of each sample beverage, and evaluated each sample beverage for coffee-specific sweet aroma (sweet aroma) and the absence of any miscellaneous flavor sensation such as a burnt smell or chemical odor (miscellaneous flavor). Specifically, the stronger the sweet aroma, the higher the score. The score was graded from 0 to 100. Specifically, the weaker the miscellaneous flavor sensation, the higher the score. The score was graded from 0 to 100. In addition, a coffee extract (diluted to 1.3% Brix) made by drip extraction of roasted and ground Brazilian No.2 SS coffee beans in a routine procedure was used as a reference product. The sweet aroma of such a coffee extract was scored as 0, and the absence of miscellaneous flavor sensation was scored as 50.

[0055] Fig. 1 shows the results. Fig. 1 has demonstrated that the introduction of the Liqui-Cel processing during the production of a coffee extract as in the present invention caused a decrease in miscellaneous flavor in the coffee extract, thereby giving a stronger sensation of coffee-specific sweet aroma.

INDUSTRIAL APPLICABILITY

[0056] The present invention is highly industrially applicable because of involvement with novel means for providing a coffee extract with enhanced coffee-specific aroma and reduced

miscellaneous flavor.

CLAIMS

1. A method for producing a coffee extract, comprising:
 - a) a first extraction step of supplying water to a column packed with roasted and ground coffee beans and collecting a coffee extract until an extraction rate reaches 1.0% or more and 20.0% or less, where the extraction rate is defined as a solid content concentration (Brix) of the collected coffee extract based on a weight of the roasted and ground coffee beans and is calculated using the following formula:
$$\frac{(\text{a liquid volume (kg) of the coffee extract collected in the first extraction step} \times \text{Brix (\%) of the coffee extract collected in the first extraction step})}{(\text{a weight (kg) of the roasted and ground coffee beans in the column})};$$
 - b) a second extraction step of collecting, after the first extraction step, a coffee extract until an extraction rate is further increased by 1.0% or more and 15.0% or less, where the extraction rate is calculated by the following formula:
$$\frac{(\text{a liquid volume (kg) of the coffee extract collected in the second extraction step} \times \text{Brix (\%) of the coffee extract collected in the second extraction step})}{(\text{a weight (kg) of the roasted and ground coffee beans in the column})};$$
 - c) a step of separating gas contained in the coffee extract obtained in the second extraction step using a non-thermal procedure; and
 - d) a step of mixing the coffee extract obtained in the first extraction step with the coffee extract from which the gas has been separated.
2. The production method according to claim 1, wherein the gas separation using the non-thermal procedure in step c) is performed by membrane processing.
3. The production method according to claim 1 or 2, wherein an amount of the roasted and ground coffee beans packed per L of column volume is 0.01 kg or more and 0.50 kg or less.
4. The production method according to any one of claims 1 to 3, wherein the water supplied to the column in the first extraction step has a temperature of 40°C or higher and

120°C or lower.

5. The production method according to any one of claims 1 to 4, wherein water supplied to the column in the second extraction step has a temperature of 40°C or higher and 120°C or lower.

6. A method of enhancing coffee-specific aroma and reducing miscellaneous flavor in a coffee extract, comprising:

a) a first extraction step of supplying water to a column packed with roasted and ground coffee beans and collecting a coffee extract until an extraction rate reaches 1.0% or more and 20.0% or less, where the extraction rate is defined as a solid content concentration (Brix) of the collected coffee extract based on a weight of the roasted and ground coffee beans and is calculated using the following formula:

$$\frac{(\text{a liquid volume (kg) of the coffee extract collected in the first extraction step} \times \text{Brix (\%) of the coffee extract collected in the first extraction step})}{(\text{a weight (kg) of the roasted and ground coffee beans in the column})};$$

b) a second extraction step of collecting, after the first extraction step, a coffee extract until an extraction rate is further increased by 1.0% or more and 15.0% or less, where the extraction rate is calculated by the following formula:

$$\frac{(\text{a liquid volume (kg) of the coffee extract collected in the second extraction step} \times \text{Brix (\%) of the coffee extract collected in the second extraction step})}{(\text{a weight (kg) of the roasted and ground coffee beans in the column})};$$

c) a step of separating gas contained in the coffee extract obtained in the second extraction step using a non-thermal procedure; and

d) a step of mixing the coffee extract obtained in the first extraction step with the coffee extract from which the gas has been separated.