

DESCRIPTION

ROASTED COFFEE BEAN, COFFEE EXTRACT, AND METHOD FOR PRODUCING SAME

TECHNICAL FIELD

[0001] The present invention relates to a roasted coffee bean, a coffee extract, and a method for producing the same.

BACKGROUND ART

[0002] Coffee is commonly consumed throughout the world. Various factors affect the flavor of the coffee. For example, varieties, cultivation conditions (such as production area and climate), roasting conditions, and extraction conditions of coffee beans as raw materials may affect the flavor of the coffee. For this reason, attempts have been made to obtain coffee with desired flavor characteristics by devising processes until coffee is obtained. PTL 1 discloses that a flavor is produced by steam distillation in the presence of reducing sugar, amino acids, and roasted coffee beans as a binder. PTL 2 discloses a method for roasting a green coffee bean to improve an unpleasant smell and bitterness of a low-grade coffee bean, the method including a primary roasting step of firing the surface of green coffee beans to be porous, a water-sprinkling and stirring treatment step of sprinkling water on the coffee beans and stirring them and a secondary roasting step of roasting the coffee beans that have undergone the treatment step. PTL 3 discloses that, in order to obtain a coffee beverage having an enhanced chlorogenic acid content, green coffee beans are brought into contact with saturated steam under high temperature and high pressure in a pressure vessel before the green coffee beans are roasted.

CITATION LIST

PATENT LITERATURE

[0003] PTL 1: Japanese Patent Laid-Open No. 2013-94124

PTL 2: Japanese Patent Laid-Open No. 2011-147401

PTL 3: Japanese Patent No. 5295559

SUMMARY OF INVENTION

TECHNICAL PROBLEM

[0004] Coffee beans having a fruity flavor are obtained from certain varieties. Such coffee beans are often sold at a high price because they are rare, and are not at a general price. An object of the present invention is to provide a roasted coffee bean or coffee extract with an improved fruity flavor.

SOLUTION TO PROBLEM

[0005] The present inventors have conducted research focusing on raw materials and production conditions of roasted coffee beans or extracts, as well as components contributing to the coffee aroma, and have found that a combination of a selection of specific green coffee beans and steam treatment set to specific conditions is beneficial for the improvement of the fruity flavor. Based on such findings, the present inventors have completed the present invention.

[0006] The present invention provides, but is not limited to, the following:

- (1) A roasted coffee bean, wherein
a diluted solution (Brix: 0.1) of a hot-water extract solution of the roasted bean contains 1 ppb or more of linalool (A), and
has a content ratio of linalool (A) to guaiacol (B) ((A)/(B)) of 0.05 or more.
- (2) The roasted coffee bean according to (1), wherein the diluted solution (Brix: 0.1) of the hot-water extract solution of the roasted bean contains 20 ppb or less of guaiacol (B).
- (3) A coffee extract, wherein
a diluted solution thereof with Brix of 0.1 contains 1 ppb or more of linalool (A), and
has a content ratio of linalool (A) to guaiacol (B) ((A)/(B)) of 0.05 or more.
- (4) The coffee extract according to (3), wherein the diluted solution thereof with Brix of 0.1 contains 20 ppb or less of guaiacol (B).
- (5) The coffee extract according to (3) or (4) having Brix of 10% or more.
- (6) A food or drink containing the roasted coffee bean or the coffee extract

according to any one of (1) to (5).

(7) The food or drink according to (6), which is a coffee beverage, instant coffee, a coffee extract solution, or a coffee concentrate.

(8) A method for roasting a coffee bean for a roasted coffee bean, wherein a diluted solution (Brix: 0.1) of a hot-water extract solution of the roasted coffee bean

contains 1 ppb or more of linalool (A), and

has a content ratio of linalool (A) to guaiacol (B) ((A)/(B)) of 0.05 or more.

(9) The roasting method for a roasted coffee bean according to (8), wherein the diluted solution (Brix: 0.1) of the hot-water extract solution of the roasted coffee bean contains 20 ppb or less of guaiacol (B).

(10) A method for roasting a coffee bean, comprising a step of treating a green coffee bean from Ethiopia with steam at a temperature of 120°C to 180°C for 1 minute to 30 minutes.

(11) The method according to (10), wherein the steam is saturated steam or superheated steam.

(12) The method according to (10) or (11), for producing the roasted bean according to (1) or (2).

(13) A method for producing a coffee extract, comprising a step of obtaining a coffee extract from a roasted bean obtained by the method according to any one of (10) to (12).

(14) The production method according to (13), further comprising a step of concentrating the coffee extract.

(15) The production method according to (13) or (14), further comprising a step of separating aroma from the coffee extract.

(16) The production method according to (15), further comprising a step of adding the separated aroma component to the coffee extract.

(17) The production method according to any one of (13) to (16), for producing the coffee extract according to any one of (3) to (5).

DESCRIPTION OF EMBODIMENTS

[0007] The present invention provides a roasted coffee bean, a coffee extract, and a method for producing the same.

[0008] <Roasted Coffee Bean>

The present invention provides roasted beans produced from green coffee beans, preferably roasted beans produced from green coffee beans from Ethiopia. As used herein, the term "green coffee beans from Ethiopia" refers to green coffee beans obtained from coffee cherries cultivated and harvested in Ethiopia. In other words, the cultivation and harvesting of the coffee cherries must be carried out in Ethiopia, but the subsequent processes leading to the green coffee beans after the harvesting may be done at any location.

Cultivars of green coffee beans from Ethiopia are not particularly limited. Examples of the cultivars include *Coffea arabica*, *Coffea canephora*, and *Coffea liberica*, which are referred to as the three major varieties of coffee, and derivatives thereof. The present invention may be applied to cultivars other than the Geisha varieties. In the following description, the green coffee beans and/or roasted beans thereof produced in Ethiopia are described as an example, and the description can be applied to other green coffee beans and/or roasted beans thereof.

[0009] The roasted beans of the present invention contain linalool (A). The content of (A) in a diluted solution (Brix: 0.1) of an extract solution obtained by a predetermined extraction method of the roasted beans is, for example, 1 ppb or more, preferably 1.3 ppb or more, and more preferably 1.7 ppb or more. If necessary, the content of (A) in a diluted solution (Brix: 0.1) of an extract solution obtained by a predetermined extraction method of the roasted beans may be 1000 ppb or less, preferably 500 ppb or less, and more preferably 100 ppb or less.

[0010] The content ratio of linalool (A) to guaiacol (B) ((A)/(B)) in the roasted beans of the present invention is adjusted to a specific range. For example, (A)/(B) of a diluted solution (Brix: 0.1) of an extract solution obtained by a predetermined extraction method of the roasted beans can be adjusted to 0.05 or more, preferably 0.7 or more, and more preferably

1.0 or more.

[0011] The roasted beans of the present invention can be further defined by guaiacol (B). The content of (B) in a diluted solution (Brix: 0.1) of an extract solution obtained by a predetermined extraction method of the roasted beans is, for example, 20 ppb or less, preferably 17 ppb or less, and more preferably 14 ppb or less.

[0012] The content of (A) correlates with the intensity of a fruity aroma that is rare in coffee. As the content of (A) increases, the aroma of fruits such as lemons and grapes is more likely to be sensed. In addition, the content of (B) correlates with the intensity of a smoky or earthy smell sensed from the middle to last when drinking coffee. As the content of (B) decreases, the flavor of coffee becomes less off-flavor, cleanliness is improved, and a fruity aroma of (A) or the like is easily sensed. Thus, roasted coffee beans with an enhanced fruity aroma and reduced smoky or earthy smell contained in coffee can be obtained by adjusting the contents of (A) and (B) and the ratio of both contents ((A)/(B)) within an appropriate range as indicators.

[0013] The content of (A), the content of (B), and the content ratio of ((A)/(B)) are values measured for a diluted solution (Brix: 0.1) of an extract solution obtained by a predetermined extraction method of roasted beans. They can be determined as described below. Roasted beans are ground into medium particles using a grinder (Coffee Mill KG366J manufactured by DeLonghi) to obtain a ground product. Twenty (20) g of the ground product is subjected to hot-water extraction with 350 g of ion-exchange water to obtain an extract solution. The extraction can be performed using a coffee maker (Coffee Maker ET-102, manufactured by Kalita Co., Ltd.). The obtained extract solution is diluted to prepare a diluted solution with Brix of 0.1%. Borneol is added as an internal standard substance to 10 ml of the diluted solution so as to have a concentration of 10 ppb, and 3.0 g of sodium chloride (NaCl) is further added and dissolved. This is used as a sample for measurement, and the contents of (A) and (B) in a diluted solution (Brix: 0.1) of an extract solution obtained by a predetermined extraction method of roasted beans are subjected to quantitative analysis by GC-MS set under the following conditions:

- GC main apparatus: model number "7890A", manufactured by Agilent Technologies
- MS detector: model number "5975C inert XL MSD", manufactured by Agilent Technologies
- Pre-treatment apparatus: "Multipurpose Sampler MPS for GC", manufactured by Gerstel
- Sample injection conditions: Dynamic head-space (DHS) method
- Tube: Tenax TA, carbon bx1000
- Column: HP-INNOWAX (60 m × 0.25 mm × 0.5 μm), manufactured by Agilent Technologies

Flow rate: 1.5 mL/min

Pressure: 160 kPa

- Injection method: splitless
- Oven: temperature rise from 40°C to 240°C at a rate of temperature rise of 7.5°C /min
- Ion source temperature: 260°C
- Analytical mode: selected ions (SIMs), linalool: 71.93 m/z, guaiacol: 109.124 m/z

The concentration of each aroma component is calculated by analyzing a single standard sample at different concentrations in the same manner as described above and creating a calibration curve from the peak area to perform quantitative analysis.

[0014] The concentrations of the aroma components in the roasted coffee beans are measured by the above-described method. As a result, the contents of linalool and guaiacol in the diluted solution (Brix: 0.1) of the extract solution are obtained.

[0015] The fruity aroma and cleanliness can be evaluated by sensory evaluation, for example, by a method described in Examples.

[0016] The present invention further provides a method for roasting coffee beans or a method for producing roasted coffee beans. The production method comprises a steam treatment step and a roasting step.

[0017] The steam treatment step involves treating green coffee beans with steam. The green coffee beans are preferably from Ethiopia. The green coffee beans from Ethiopia may also be cultivars other than the Geisha varieties. The steam is steam at 120°C to 190°C, preferably 150°C to 185°C, and more preferably 160°C to 180°C. The time of the steam

treatment is 1 minute to 30 minutes, preferably 1 minute to 20 minutes, and more preferably 1 minute to 10 minutes. For example, when the steam treatment of the green coffee beans is performed at 160°C to 180°C, the treatment time can be about 1 minute to 10 minutes or about 1 minute to 5 minutes. Alternatively, the time can be about 1 minute to 10 minutes at 160°C or 170°C or about 1 minute to 5 minutes at 180°C.

[0018] The steam may be saturated steam or superheated steam. The facility for performing the steam treatment step is not limited, but a vessel capable of corresponding to a high-temperature and high-pressure state, such as a Class 1 pressure vessel, may be used. In many cases, the facility is capable of supplying predetermined high-pressure steam from a pipe and tightly plugging the outlet of the vessel. At this point, the high-pressure steam can be either saturated steam or superheated steam. It is unexpected to find that the fruity aroma is improved by subjecting specific green coffee beans such as green coffee beans from Ethiopia to a steam treatment set under specific conditions.

[0019] The roasting step involves roasting the coffee bean treated with steam. In this step, the coffee beans are roasted to an arbitrary roasting degree within a range suitable for drinking. For example, the roasting degree can be set to an L value of 15 to 30, preferably 17 to 25, and more preferably 19 to 22. Here, the L-value is the degree of roasting of coffee beans expressed by color, where white has an L-value of 100 and black has an L-value of 0. In other words, the more the coffee beans are roasted, the smaller the L value becomes. Herein, the L-value is measured by a method described below.

[0020] Roasted coffee beans are ground into medium particles using a coffee grinder (BONMAC Coffee Mill BM-250N (Lucky Coffee Machine Co., Ltd.)). A Petri dish is filled with the ground beans in an amount to be leveled off, and the leveled surface is covered with an L-value measuring machine (colorimeter CR-410 (Konica Minolta Inc.)) to measure the L value.

[0021] The present invention further provides roasted coffee beans obtained by the method for roasting coffee beans or the method for producing roasted coffee beans. Examples of the roasted coffee beans include the roasted coffee beans described above.

[0022] <Extract of Roasted Bean>

The present invention further provides extracts of the roasted beans described above (coffee extracts). The extracts of the present invention include an extract solution that is extracted from roasted coffee beans, a concentrate thereof, or those having a sufficiently high solid concentration in the liquid at the time of extraction. The extract of the present invention contains linalool (A). The content of (A) in a diluted solution (Brix: 0.1) of the extract is, for example, 1 ppb or more, preferably 1.3 ppb or more, and more preferably 1.7 ppb or more. If necessary, the content of (A) in a diluted solution (Brix: 0.1) of the extract may be 1000 ppb or less, preferably 500 ppb or less, and more preferably 100 ppb or less.

[0023] The content ratio of linalool (A) to guaiacol (B) ((A)/(B)) in the extracts of the present invention is adjusted to a specific range. For example, (A)/(B) of a diluted solution (Brix: 0.1) of the extract can be adjusted to 0.05 or more, preferably 0.7 or more, and more preferably 1.0 or more.

[0024] The extracts of the present invention can be further defined by guaiacol (B). The content of (B) in a diluted solution (Brix: 0.1) of the extract is, for example, 20 ppb or less, preferably 17 ppb or less, and more preferably 14 ppb or less.

[0025] The content of (A), the content (B), and the content ratio of (A)/(B) in the extract of the present invention can be determined by GC-MS described above using a diluted solution with Brix of 0.1 prepared by appropriately diluting the extract.

[0026] The extracts of the present invention can have Brix of 10% or more, preferably 20% or more, and more preferably 30% or more. Such an extract is easily transported because of its high concentration as compared with a coffee extract solution having a low concentration. Thus, the extracts of the present invention are beneficial for long-distance transportation or the like.

[0027] The content of (A) correlates with the intensity of a fruity aroma that is rare in coffee. As the content of (A) increases, the aroma of fruits such as lemons and grapes is more likely to be sensed. In addition, the content of (B) correlates with the intensity of a smoky or earthy smell sensed from the middle to last when drinking coffee. As the content

of (B) decreases, the flavor of coffee becomes less off-flavor, cleanliness is improved, and a fruity aroma of (A) or the like is easily sensed. Thus, extracts with an enhanced fruity aroma and reduced smoky or earthy smell contained in coffee can be obtained by adjusting the contents of (A) and (B) and the ratio of both contents ((A)/(B)) within an appropriate range as indicators.

[0028] The present invention further provides a method for producing an extract of roasted beans (coffee extract). The production method comprises a step of using roasted beans or roasted beans obtained by the production method described above to extract an extract from the roasted beans. In this production method, an extract is produced using the contents of linalool (A) and guaiacol (B), which are specific components, and the content ratio of both components ((A)/(B)) as indicators, in order to achieve a refreshing and clean taste while maintaining/enhancing the fruity aroma enhanced by the roasted coffee beans and reducing smoky or earthy smell contained in coffee. (A), (B), the ratio of (A)/(B) and, if necessary, Brix may be set in the ranges described above for the extract.

[0029] In order to increase the extraction efficiency of the soluble solids, the roasted coffee beans may be ground before the extraction step of the extract. Grinding of the roasted coffee beans can be performed using a general grinder such as a roll mill. The grinding particle size can be, but is not particularly limited to, any particle size and shape such as coarse, medium, medium fine, and fine grinding.

[0030] In order to increase the extraction efficiency of the soluble solids, the ground coffee beans obtained in the grinding step may be steamed with water or steam (steaming step). The steaming step may be performed at any time before the extraction step, for example, immediately after the grinding step or after the extractor are filled with the ground coffee beans. The time of the steaming step can be set appropriately.

[0031] The step of extracting an extract from roasted beans may be performed by any method as long as coffee solids can be extracted. Examples thereof include drip extraction, kneader extraction, supercritical CO₂ extraction, continuous multi-tube extraction, and immersion extraction. In general, an aqueous solution in which coffee solids are dissolved,

that is, an extract, is prepared by bringing hot water at 60°C to 200°C into contact with roasted coffee beans or a ground product thereof.

[0032] The method for producing an extract of roasted beans can further comprise a step of separating the aroma from the extract. As long as aroma components can be separated from the extract, the method of separating the aroma is not limited. Examples thereof include steam distillation, tray distillation, and an aroma separation apparatus. In general, the separated aroma fraction does not contain coffee solids and therefore has a low Brix. The aroma fraction can be mixed with the extract at any later stage. For example, the aroma fraction can be added to the extract that has undergone a concentration step described below. By performing this step, aroma components (including fruity flavor) can be avoided from being lost in the extract concentration step.

[0033] The method for producing an extract of roasted beans can further comprise subjecting the extract to a "concentration" step. The method of concentrating the extract can be broadly classified into thermal concentration and freeze concentration, either of which may be available, and is not particularly limited. In general, the extract that has undergone the concentration step can have Brix of 10% or more.

[0034] <Food or Drink>

The present invention further provides a food or drink containing or consisting of the above-described roasted beans or extracts of roasted beans. The food or drink may have, but is not limited to, an improved fruity flavor of the coffee. Here, the food or drink includes an ingredient or a raw material for food or drink, an intermediate product, a half-finished product (which has not been completed but has substantially the same configuration as a final product), and a final product. For example, the food or drink may have a content ratio of linalool (A) to guaiacol (B) ((A)/(B)) of 0.05 or more.

[0035] The form in which the roasted beans or extracts thereof are present in the food or drink is not particularly limited. For example, the roasted beans or extracts thereof can be present in the food or drink as they are. Alternatively, the roasted beans or extracts thereof can be present in the food or drink after being subjected to some processing. Examples of

some processing herein include, but are not limited to, a concentrate, a diluted product, a dried product, a powder, a ground product, granules, a granulated product, a coated product, an emulsion (an oil-in-water emulsion, a water-in-oil emulsion, etc.), a paste, a gel, a tablet, and a capsule, which are related to roasted beans or extracts thereof.

[0036] The food or drink can be, for example, roasted coffee beans. The roasted coffee beans may be composed of only the roasted beans of the present invention or may be composed of a blend with other roasted beans. The shape thereof is not particularly limited and may be roasted beans or ground beans.

[0037] The food or drink can be, for example, an instant product. The instant product can be brought into a state suitable for eating or drinking by mixing with a solvent for food or drink (water, alcohol, fruit juice, milk, etc.). Examples of the instant product include instant coffee, a coffee extract solution, concentrated portion, and concentrated syrup.

[0038] In addition, the food or drink may be a beverage, a soft drink, an alcoholic beverage, a confectionery, or the like, and may be, for example, a coffee beverage.

[0039] The food or drink may be in the packaged form for the purpose of storage, transportation, or distribution in the market. A container of any form and material may be used, and for example, a container such as a bottle, a can, a barrel, paper, a drip bag, a retort, or a PET bottle (a plastic bottle) can be used.

EXAMPLES

[0040] Specific examples of the present invention are given in the present Examples. The present Examples are provided for the purpose of understanding the present invention and are not intended to limit the scope of the present invention.

[0041] [Test Example 1] Investigation of influence of steam treatment condition on aroma component in coffee bean

(1) Preparation of steam-treated roasted coffee bean

A predetermined amount (4 kg) of green coffee beans of Ethiopian (*Coffea arabica*) Sidamo was weighed and set in a pressure cooker for steam treatment. The green coffee beans were subjected to steam treatment under the conditions (temperature and time) shown

in Table 1 (Examples 1 to 9 and Comparative Examples 1 to 6). Here, the time of the steam treatment indicates the time from when steam was blown into the cooker to reach the temperature (pressure) shown in Table 1. After the steam treatment, the coffee beans collected from the pressure cooker were cooled with cold air and returned to room temperature. The steam-treated beans were roasted using a sample roaster manufactured by Probat to obtain roasted beans having an L value of 21.

[0042] (2) Aroma analysis of roasted coffee bean

The obtained roasted coffee beans were ground into medium particles using a coffee mill KG366J manufactured by DeLonghi. The ground roasted beans (20 g) were set in a dripper, and extraction was performed with 350 g of hot water (ion-exchange water, about 100°C) using a coffee maker ET-102 manufactured by Kalita Co., Ltd. The extraction was continued until the hot water was completely supplied from the coffee maker, and the resulting extract solution was cooled with cold water. The extract solution had Brix of about 1.6 to 4.2 (Table 1). The obtained extract solution was diluted to prepare a diluted solution with Brix of 0.1. Borneol was added as an internal standard substance to 10 ml of the diluted solution so as to have a concentration of 10 ppb, and 3.0 g of sodium chloride (NaCl) was further added and dissolved. This was used as the sample for measurement, and quantitative analysis was performed by GC-MS set to the conditions described above to measure the contents of linalool (A) and guaiacol (B) in the hot-water extract solution (Brix: 0.1) of roasted beans. Then, (A)/(B) was calculated based on the quantitative values of (A) and (B).

[0043] [Table 1]

	Extract solution	Steam treatment condition		Aroma analysis		
	Bx[%]	Temperature [°C]	Time [min]	Linalool	Guaiacol	Linalool/guaiacol
Comparative Example 1	1.8	-	-	0.93	22.0	0.042
Comparative Example 2	2.0	100	5	0.97	13.4	0.072
Example 1	2.3	120	30	1.44	14.4	0.100
Example 2	1.7	140	20	1.52	15.7	0.097
Example 3	1.6	150	1	1.25	15.4	0.081
Example 4	1.7	150	20	1.53	14.0	0.109
Example 5	1.7	150	30	1.16	14.1	0.083
Example 6	1.7	160	5	1.91	9.2	0.207
Example 7	1.6	160	10	1.73	8.9	0.195
Comparative Example 3	2.3	160	20	0.84	6.1	0.139
Comparative Example 4	3.4	160	40	0.25	4.9	0.051
Example 8	1.7	170	5	1.58	13.2	0.120
Example 9	1.7	180	1	1.52	16.4	0.093
Comparative Example 5	4.2	180	10	0.52	5.2	0.100
Comparative Example 6	4.0	200	1	0.83	5.0	0.166

In the table, Bx represents "Brix". The values of linalool and guaiacol represent the content (ppb) in the diluted solution (Brix: 0.1) of the extract solution. The values for linalool/guaiacol represent the ratio of the contents in the diluted solution (Brix: 0.1) of the extract solution.

[0044] When green coffee beans from Ethiopia were subjected to steam treatment at 120°C to 180°C for 1 minute to 30 minutes (Examples 1 to 9), the diluted solution (Brix: 0.1) of the extract solution had a linalool content of 1 ppb or more and a guaiacol content of 20 ppb or less. The content ratio of linalool to guaiacol was 0.05 or more.

[0045] In contrast, Comparative Example 1 did not have a linalool content of 1 ppb or more or a content ratio of linalool to guaiacol of 0.05 or more in the diluted solution (Brix: 0.1) of the extract solution. This may be because no steam treatment was performed on the green coffee beans.

[0046] Comparative Examples 2 to 6 had a linalool content of less than 1 ppb in the diluted solution (Brix: 0.1) of the extract solution. This suggests that there is an appropriate

combination of temperature and time of steam treatment to obtain roasted beans having a linalool content of 1 ppb or more and a content ratio of linalool to guaiacol of 0.05 or more.

[0047] [Test Example 2] Investigation of the production area of green coffee bean

In Test Example 1, one type of green coffee beans (Sidamo, from Ethiopia) was used to examine the influence of steam treatment conditions (temperature and time) on aroma components. In Test Example 2, green coffee beans from different production areas were subjected to steam treatment under the same conditions, and the influence on the aroma components was examined and evaluated.

[0048] (1) Preparation of steam-treated roasted coffee bean

Three types of arabica green coffee beans from Ethiopia (Sidamo (Example 8 and Comparative Example 1), Harkankenino (Example 10), and Yirgacheffe (Example 11)) were prepared. Three types of green coffee beans not from Ethiopia (Brazilian (Comparative Example 7), Guatemala (Comparative Example 8), and Vietnam (Comparative Example 9)) were prepared as Comparative Examples. Here, the green coffee beans from Brazil and Guatemala were arabica varieties, while the green coffee beans from Vietnam were canephora varieties. The prepared green coffee beans were subjected to a steam treatment under the conditions (170°C, 5 minutes) of Example 8 in Test Example 1. The steam-treated beans were roasted under the same conditions as in Test Example 1 to obtain roasted beans having an L value of 21.

[0049] (2) Aroma analysis of roasted coffee bean

A diluted solution (Brix: 0.1) of the extract solution was obtained from the resulting roasted beans by the procedure described in Test Example 1. Using the diluted solution, GC-MS analysis was performed in the same manner as in Test Example 1 to quantitatively analyze linalool (A) and guaiacol (B) and further calculate (A)/(B).

[0050] [Table 2]

	Raw material bean		Extract solution	Aroma analysis		
	Type of green coffee bean	Steam treatment condition	Bx[%]	Linalool	Guaiacol	Linalool/guaiacol
Comparative Example 1	Ethiopian Sidamo	None	1.83	0.93	22.04	0.042
Example 8	Ethiopian Sidamo	170°C 5min	1.72	1.58	13.17	0.120
Example 10	Ethiopian Harkankenino	170°C 5min	1.98	2.11	11.93	0.177
Example 11	Ethiopian Yirgacheffe	170°C 5min	1.86	2.29	7.46	0.307
Comparative Example 7	Brazil No2	170°C 5min	2.14	0.01	22.98	0.001
Comparative Example 8	Guatemala SHB	170°C 5min	2.09	0.69	7.60	0.091
Comparative Example 9	Vietnam G1	170°C 5min	1.60	0.00	24.74	0.000

In the table, Bx represents "Brix". The values of linalool and guaiacol represent the content (ppb) in the diluted solution (Brix: 0.1) of the extract solution. The values for linalool/guaiacol represent the ratio of the contents in the diluted solution (Brix: 0.1) of the extract solution.

[0051] Examples 8, 10, and 11 each had a linalool content of 1 ppb or more and a content ratio of linalool to guaiacol of 0.05 or more in the diluted solution (Brix: 0.1) of the extract solution. This may be because the steam treatment was performed on the green coffee beans from Ethiopia under appropriate conditions.

[0052] In contrast, Comparative Example 1 did not have a linalool content of 1 ppb or more or a content ratio of linalool to guaiacol of 0.05 or more in the diluted solution (Brix: 0.1) of the extract solution. This may be because the green coffee beans from Ethiopia were used but not subjected to steam treatment.

[0053] Comparative Examples 7 to 9 did not have a linalool content of 1 ppb or more or a content ratio of linalool to guaiacol of 0.05 or more in the diluted solution (Brix: 0.1) of the extract solution. This may be because the conditions of steam treatment are appropriate, but green coffee beans from Ethiopia are not used.

[0054] [Test Example 3] Production and evaluation of coffee extract

Example 12: Preparation of extract with enhanced fruity flavor using steam-treated coffee bean (Type 1)

A coffee extract was prepared using the roasted beans of Example 8 in Test Example 1 as a raw material. Example 8 is roasted beans (L value: 21) obtained by subjecting green coffee beans (Ethiopian Sidamo) to steam treatment (at 170°C for 5 minutes) and then to roasting treatment. After grinding the roasted beans with a roll mill-type grinder, extraction of the coffee solids was carried out using a continuous multiple-tube extractor at a maximum extraction temperature of 165°C. Each column was filled with 5.4 kg of the ground beans, and the extraction was continued until a predetermined amount of extract solution was obtained, giving 24.6 kg of extract solution per column as liquid volume. The obtained extract solution was cooled in a plate heat exchanger. Then, the whole amount of the obtained extract solution was treated in an aroma separation apparatus to perform aroma separation. Further, the residual coffee liquid (coffee solids) after aroma separation treatment was/were concentrated by volatilizing water at a temperature of about 50 to 60°C using a centrifugal thin-film vacuum evaporator (manufactured by OKAWARA MFG. CO., LTD.). The concentrated coffee liquid and the separated aroma were mixed to obtain a coffee extract (Example 12).

[0055] Example 13: Preparation of extract with enhanced fruity flavor using steam-treated coffee bean (Type 2)

In the same manner as in Example 12, a coffee extract was prepared using the roasted beans of Example 8 in Test Example 1 as a raw material. After the steam-treated roasted coffee beans were ground with a roll mill-type grinder, extraction of the coffee solids was carried out using a continuous multiple-tube extractor at a maximum extraction temperature of 135°C. Each column was filled with 5.4 kg of the ground beans, and the extraction was continued until a predetermined amount of extract solution was obtained. The extract solution was separated into 3.5 kg of the first half of extraction (first half liquid) and 29.4 kg of the second half of extraction (second half liquid). The obtained extract solution (both the first half liquid and the second half liquid) was cooled in a plate heat

exchanger. The second half liquid of the extract solution was treated in an aroma separation apparatus to perform aroma separation. Further, the residual coffee liquid (coffee solids) after aroma separation was/were concentrated by volatilizing water at a temperature of about 50 to 60°C using a centrifugal thin-film vacuum evaporator (manufactured by OKAWARA MFG. CO., LTD.). The concentrated coffee liquid (derived from the second half liquid of the extract solution), the separated aroma, and the first half liquid of the extract solution were mixed to obtain a coffee extract (Example 13).

[0056] Comparative Examples 10 to 11: Preparation of extract using steam-untreated coffee bean

Two concentrated extracts obtained from roasted coffee beans (Sidamo) from Ethiopia were purchased and used as Comparative Examples. The preparation method of the extract will be described. Green coffee beans (steam-untreated) are roasted to a roasting degree of L-22, and the resulting roasted beans are ground and then subjected to extraction using a continuous extractor to obtain an extract solution. A coffee extract obtained by evaporating and concentrating the above extract solution is Comparative Example 10. Meanwhile, the extract solution is subjected to aroma separation, and the resulting residual coffee liquid is concentrated by evaporation. The coffee extract obtained by blending the resulting concentrated coffee liquid and the separated aroma is Comparative Example 11.

[0057] Analysis of coffee extract: The coffee extract obtained above had Brix of 14.7 to 40.5% (Table 3). The obtained coffee extract was diluted with ion-exchange water to obtain a diluted solution (Brix: 0.1). Using the diluted solution, GC-MS analysis was performed as shown in Test Example 1 to quantitatively analyze linalool (A) and guaiacol (B) and further calculate (A)/(B). Since Comparative Examples 10 and 11 shown in Table 3 are purchased extracts, the extraction rate from roasted beans is unknown.

[0058] [Table 3]

	Raw material		Production process	Coffee extract	Aroma analysis		
	Steam treatment	L value		Bx[%]	Linalool	Guaiacol	Linalool/guaiacol
Comparative Example 10	None	22	Extraction and concentration	40.5	0.16	4.69	0.03
Comparative Example 11	None	22	Extraction, separation of aroma, and concentration	40.5	0.49	1.60	0.31
Example 12	170°C 5min	21	Extraction, separation of aroma, and concentration	25.2	1.12	3.24	0.35
Example 13	170°C 5min	21	Extraction, separation of aroma, and concentration	14.7	1.81	9.25	0.20

In the table, Bx represents "Brix". The values of linalool and guaiacol represent the content (ppb) in the diluted solution (Brix: 0.1) of the extract solution. The values for linalool/guaiacol represent the ratio of the contents in the diluted solution (Brix: 0.1) of the extract solution.

[0059] Examples 12 and 13 had a linalool content of 1 ppb or more and a content ratio of linalool to guaiacol of 0.05 or more in the diluted solution (Brix: 0.1) of the extract solution. This may indicate that steam treatment is also effective for coffee extracts that have undergone aroma separation before the concentration step.

[0060] In contrast, Comparative Examples 10 and 11 did not have a linalool content of 1 ppb or more or a content ratio of linalool to guaiacol of 0.05 or more in the diluted solution (Brix: 0.1) of the extract solution. This may be because the green coffee beans from Ethiopia were used but not subjected to steam treatment.

[Test Example 4] Sensory Evaluation

Each of the roasted coffee beans produced above (Examples and Comparative Examples) was ground with a coffee bean grinder (manufactured by DeLonghi). 180 g of hot water (ion-exchange water) heated to 100°C was added to 10 g of the resulting ground product. After standing for 4 minutes, the mixture was largely stirred with a cupping spoon three times in a vertical motion so that the powder that had floated up was allowed to sink. Bubbles and ground products of beans produced in the supernatant of the mixture were removed. The mixture was allowed to stand until the temperature reached room temperature, and the same amount of liquid was scooped with a cupping spoon each time and

sucked into the mouth for sensory evaluation.

[0061] However, for Examples 12 and 13, coffee extracts were each obtained according to the method described in Test Example 3. The coffee extract was diluted with ion-exchange water to adjust the Brix to 1.3%. The diluted solution was subjected to sensory evaluation.

[0062] In addition, green coffee beans that had not been subjected to steam treatment were used as a standard product, treated in the same manner as described above, and subjected to sensory evaluation. In other words, 100 g of standard green coffee beans were put into a roaster (NOVO MARK II (Daiichi Denshi Inc.)) and roasted with the following program to obtain roasted coffee beans. An extract solution was prepared from the roasted coffee beans according to the above and subjected to sensory evaluation.

[0063] [Table 4]

Step	Temperature °C	Airflow rate (%)	Time (sec)
1	110	60	45
2	120	60	45
3	125	60	45
4	130	60	60
5	150	60	60
6	170	60	60
7	190	60	75
8	220	60	90
9	235	60	60
10	255	60	55

In the sensory evaluation, four sensory panelists evaluated fruitiness and cleanliness. Both the evaluation of fruitiness and cleanliness were scored on an eight-grade scale. The score of the standard product was used as a reference for the evaluation. For both the fruitiness and the cleanliness, 3 points or higher were considered acceptable. The results are shown in the table below.

[0064] [Table 5]

	Raw material bean	Temperature [°C]	Time [min]	Fruitiness score	Cleanliness score
Standard product	Brazil No. 2	-	-	1.0	1.0
Comparative Example 2	Ethiopian Sidamo	100	5	2.6	2.6
Example 2	Ethiopian Sidamo	140	20	3.5	3.6
Example 7	Ethiopian Sidamo	160	10	3.8	3.6
Example 8	Ethiopian Sidamo	170	5	3.9	3.5
Comparative Example 5	Ethiopian Sidamo	180	10	2.6	2.4
Example 10	Ethiopian Harkankenino	170	5	5.4	5.0
Example 11	Ethiopian Yirgacheffe	170	5	4.5	4.1
Comparative Example 7	Brazil No. 2	170	5	1.3	2.0
Example 12	Ethiopian Sidamo	170	5	3.3	4.3
Example 13	Ethiopian Sidamo	170	5	3.7	4.6

In the table, the scores for fruitiness and cleanliness are the average of scores given by the four sensory panelists, the temperature [°C] represents the temperature of the steam treatment, and the time [min] represents the time of the steam treatment.

[0065] The samples in Examples had a fruitiness score of 3 points or higher and a cleanliness score of 3 points or higher, whereas the samples in Comparative Examples had both a fruitiness score and a cleanliness score of lower than 3 points. It is thus confirmed that the roasted coffee beans or samples having a linalool content of 1 ppb or more and a content ratio of linalool to guaiacol of 0.05 or more in the diluted solution (Brix: 0.1) of the extract solution have an improved fruity aroma and cleanliness.

CLAIMS

1. A roasted coffee bean, wherein
a diluted solution (Brix: 0.1) of a hot-water extract solution of the roasted bean
comprises 1 ppb or more of linalool (A), and
has a content ratio of linalool (A) to guaiacol (B) ((A)/(B)) of 0.05 or more.
2. The roasted coffee bean according to claim 1, wherein the diluted solution (Brix: 0.1) of the hot-water extract solution of the roasted bean comprises 20 ppb or less of guaiacol (B).
3. A coffee extract, wherein
a diluted solution thereof with Brix of 0.1
comprises 1 ppb or more of linalool (A), and
has a content ratio of linalool (A) to guaiacol (B) ((A)/(B)) of 0.05 or more.
4. The coffee extract according to claim 3, wherein the diluted solution thereof with Brix of 0.1 comprises 20 ppb or less of guaiacol (B).
5. The coffee extract according to claim 3 or 4, having Brix of 10% or more.
6. A food or drink comprising the roasted coffee bean or the coffee extract according to any one of claims 1 to 5.
7. The food or drink according to claim 6, which is a coffee beverage, instant coffee, a coffee extract solution, or a coffee concentrate.
8. A method for roasting a coffee bean for a roasted coffee bean, wherein a diluted solution (Brix: 0.1) of a hot-water extract solution of the roasted coffee bean
comprises 1 ppb or more of linalool (A), and
has a content ratio of linalool (A) to guaiacol (B) ((A)/(B)) of 0.05 or more.
9. The roasting method for a roasted coffee bean according to claim 8, wherein the diluted solution (Brix: 0.1) of the hot-water extract solution of the roasted coffee bean comprises 20 ppb or less of guaiacol (B).
10. A method for roasting a coffee bean, comprising a step of treating a green coffee

bean from Ethiopia with steam at a temperature of 120°C to 180°C for 1 minute to 30 minutes.

11. The method according to claim 10, wherein the steam is saturated steam or superheated steam.
12. The method according to claim 10 or 11, for producing the roasted bean according to claim 1 or 2.
13. A method for producing a coffee extract, comprising a step of obtaining a coffee extract from a roasted bean obtained by the method according to any one of claims 10 to 12.
14. The production method according to claim 13, further comprising a step of concentrating the coffee extract.
15. The production method according to claim 13 or 14, further comprising a step of separating aroma from the coffee extract.
16. The production method according to claim 15, further comprising a step of adding the separated aroma component to the coffee extract.
17. The production method according to any one of claims 13 to 16, for producing the coffee extract according to any one of claims 3 to 5.