

DESCRIPTION

CAFFEINE-CONTAINING COLORLESS TRANSPARENT DRINK

TECHNICAL FIELD

[0001] The present invention relates to caffeine-containing colorless transparent beverages, and in particular to colorless transparent beverages that are less apt to make one feel bitterness coming from caffeine.

BACKGROUND ART

[0002] In recent years, flavored water has gained popularity against the backdrop of the rise in consumers' health consciousness and natural preference. Flavored water is a beverage produced by adding ingredients such as sweetener, flavorant, essence, and/or fruit juice to water such as mineral water (including natural mineral water), and is a beverage with a water-like appearance, also called "near-water". Those beverages like flavored water, which are colorless and transparent but have a flavor of fruit or the like, generally have such a clean taste and refreshing flavor that one can drink them as an alternative to water, and are characterized by being as easy as or easier to drink than water.

[0003] In the meantime, caffeine is an ingredient found in coffee, green tea and the like, and is known to give a comfortable stimulus when one drinks a beverage containing a certain amount of caffeine. One of the main effects of caffeine is an awakening effect, and it is known that caffeine helps reduce drowsiness during daytime and sharpen concentration. Many reports have hitherto been published on caffeine-containing beverages (PTLs 1-5).

[0004] However, since caffeine is strong in bitterness, some caffeine-containing beverages may have an unfavorable taste for customers depending on the types of the beverages to which to add caffeine. Various methods for suppressing bitterness of caffeine have been long reported, and for example, it is known that polysaccharide thickeners such as gum ghatti, gluten, gum arabic and soybean polysaccharides are capable of suppressing bitterness coming from caffeine (PTL 6). Other methods for suppressing caffeine's bitterness have also been reported, but there has hitherto been no technique disclosed for effective

suppression of caffeine's bitterness particularly in colorless transparent beverages like flavored water.

CITATION LIST

PATENT LITERATURES

[0005] PTL 1: Japanese Patent Application Publication No. JP 2014-55

PTL 2: Japanese Patent No. JP 5313320

PTL 3: Japanese Patent No. JP 4745784

PTL 4: Japanese Patent No. JP 4903297

PTL 5: Japanese Patent No. JP 3082920

PTL 6: Japanese Patent Application Publication No. JP 2011-78363

SUMMARY OF INVENTION

TECHNICAL PROBLEM

[0006] If it is possible to add an appropriate amount of caffeine to transparent beverages like flavored water, then it is expected that it will be possible to provide beverages that one can drink quickly and easily on various occasions, such as immediately after awakening, during a break in daytime work, and in the middle of a walk, and which allow one to experience caffeine's effects. However, in order to ensure that colorless transparent beverages like flavored water become easy to drink like water, it is necessary to diminish the total flavor of those colorless transparent beverages. The present inventors discovered that colorless transparent beverages particularly containing a strongly bitter ingredient like caffeine are felt to be more prominent in bitterness than other common beverages (*e.g.*, colored beverages or cloudy beverages).

[0007] There have hitherto been many reports on techniques for suppressing caffeine's bitterness. However, colorless transparent beverages like flavored water are generally characterized by being relatively low in the amounts and types of other ingredients added besides water. Therefore, when another ingredient is added to colorless transparent beverages, the beverages may easily lose its balance of flavor. In fact, it has been difficult to suppress caffeine's bitterness in colorless transparent beverages while keeping the

palatability of those beverages, such as clean taste and refreshing flavor. Conventional techniques may be effective for suppressing bitterness but are inadequate to ensure the maintenance of the clean taste of colorless transparent beverages.

[0008] Thus, an object of the present invention to provide a caffeine-containing colorless transparent beverage that does not deteriorate in clean taste or refreshing flavor and is less apt to make one feel bitterness coming from caffeine.

SOLUTION TO PROBLEM

[0009] The present inventors have made intensive studies to achieve the aforementioned object, and as a result, found that when particular sugar(s) and acid(s) are added to a colorless transparent beverage containing a specified amount of caffeine, the acidity of the beverage is adjusted to an appropriate level, and the weight ratio of a content of the particular sugar(s) with respect to the acidity of the beverage is set to lie in the particular range, there can be provided a colorless transparent beverage that does not deteriorate in clean taste or refreshing flavor and is less apt to make one feel bitterness coming from caffeine. Further, the inventors found that when an alcohol with 2 or 3 carbon atoms is added in a specified amount to said beverage, the effect to suppress bitterness coming from caffeine can be further enhanced. On the basis of these findings, the inventors have completed this invention.

[0010] The present invention includes, but is not limited to, the following.

(1) A beverage comprising:

0.1 to 60 mg/100 mL of caffeine;

at least one sugar selected from the group consisting of glucose, fructose and sucrose; and

at least one acid selected from the group consisting of citric acid, malic acid, tartaric acid, phosphoric acid, lactic acid and gluconic acid;

wherein the beverage has an acidity of 0.04 to 0.31 g/100 mL;

wherein the beverage has a weight ratio of a content of said sugar to said acidity of 16 to 250;

wherein the beverage contains 0.001 to 0.5 wt.% of an alcohol with 2 or 3 carbon

atoms;

wherein the beverage has an absorbance at a wavelength of 660 nm of 0.06 or less;

and

wherein the beverage has a ΔE (color difference) value of 3.5 or less relative to pure water.

(2) The beverage as set forth in (1), wherein the beverage is a packaged beverage.

(3) A method for producing a beverage comprising:

0.1 to 60 mg/100 mL of caffeine;

at least one sugar selected from the group consisting of glucose, fructose and sucrose; and

at least one acid selected from the group consisting of citric acid, malic acid, tartaric acid, phosphoric acid, lactic acid and gluconic acid;

wherein the beverage has an absorbance at a wavelength of 660 nm of 0.06 or less;

wherein the beverage has a ΔE (color difference) value of 3.5 or less relative to pure water;

the method comprising the steps of:

adjusting acidity to be in the range of 0.04 to 0.31 g/100 mL;

adjusting a weight ratio of a content of said sugar to said acidity to be in the range of 16 to 250; and

adding an alcohol with 2 or 3 carbon atoms to the beverage.

ADVANTAGEOUS EFFECT OF INVENTION

[0011] The present invention can provide a colorless transparent beverage that does not deteriorate in clean taste or refreshing flavor and is less apt to make one feel bitterness coming from caffeine. The beverage provided by this invention is a beverage that is easy to drink like water and also exerts caffeine's effects.

DESCRIPTION OF EMBODIMENTS

[0012] One aspect of the present invention is a beverage comprising:

0.1 to 60 mg/100 mL of caffeine;

at least one sugar selected from the group consisting of glucose, fructose and sucrose; and

at least one acid selected from the group consisting of citric acid, malic acid, tartaric acid, phosphoric acid, lactic acid and gluconic acid;

wherein the beverage has an acidity of 0.04 to 0.31 g/100 mL;

wherein the beverage has a weight ratio of a content of said sugar to said acidity of 16 to 250;

wherein the beverage contains 0.001 to 0.5 wt.% of an alcohol with 2 or 3 carbon atoms;

wherein the beverage has an absorbance at a wavelength of 660 nm of 0.06 or less; and

wherein the beverage has a ΔE (color difference) value of 3.5 or less relative to pure water.

[0013] (Caffeine)

The beverage of the present invention comprises caffeine. The content of caffeine in the beverage of this invention is in the range of 0.1 to 60 mg/100 mL. The content of caffeine in the beverage of this invention is preferably 0.5 mg/100 mL or more, 1 mg/100 mL or more, 2 mg/100 mL or more, 3 mg/100 mL or more, 4 mg/100 mL or more, 5 mg/100 mL or more, 6 mg/100 mL or more, 7 mg/100 mL or more, 8 mg/100 mL or more, 9 mg/100 mL or more, or 10 mg/100 mL or more, and also is preferably 50 mg/100 mL or less, 40 mg/100 mL or less, 30 mg/100 mL or less, 20 mg/100 mL or less, 19 mg/100 mL or less, 18 mg/100 mL or less, 17 mg/100 mL or less, 16 mg/100 mL or less, 15 mg/100 mL or less, 14 mg/100 mL or less, or 13 mg/100 mL or less. The content of caffeine in the beverage of this invention is in the range of preferably 0.1 to 40 mg/100 mL, more preferably 1 to 30 mg/100 mL, yet more preferably 2 to 20 mg/100 mL. When caffeine is in the form of a hydrate or the like, the caffeine content shall be calculated in terms of its free form.

[0014] The caffeine content can be measured by following a method known to skilled artisans -- for example, using a spectroscopic method such as HPLC, LC-MS, GC-MS, LC,

GC, or near-infrared spectroscopy.

[0015] In the present invention, caffeine can be used in the form of a food additive, or in the form of an extract of a caffeine-containing plant (*e.g.*, tea leaf, cola nut, coffee bean) or a concentrate thereof. In the beverage of this invention, caffeine is used in the form of preferably a commercially available product pursuant to the food additive standard, especially preferably a pure product (*i.e.*, a purified product containing at least 98% caffeine).

[0016] (Sugar)

The beverage of the present invention comprises at least one sugar selected from the group consisting of glucose, fructose and sucrose.

[0017] The content of the aforementioned sugar in the beverage of the present invention is not particularly limited, but is for example in the range of 1 to 10 g/100 g. This content is preferably 1 g/100 g or more, 2 g/100 g or more, 3 g/100 g or more, 4 g/100 g or more, or 5 g/100 g or more, and also is preferably 10 g/100 g or less, 9 g/100 g or less, 8 g/100 g or less, or 7 g/100 g or less. The content of said sugar in the beverage of this invention is in the range of preferably 2 to 8 g/100 g, more preferably 3 to 7 g/100 mL.

[0018] The content of the aforementioned sugar is defined as the total content of at least one sugar selected from the group consisting of glucose, fructose and sucrose. In the beverage of the present invention, each one of glucose, fructose and sucrose can be used alone, or two or more thereof can be used in combination.

[0019] The contents of those different sugars can be measured by following a method known to skilled artisans -- for example, using HPLC or the like. In the present invention, a commercially available product can be used as said sugar.

[0020] (Acid)

The beverage of the present invention comprises at least one acid selected from the group consisting of citric acid, malic acid, tartaric acid, phosphoric acid, lactic acid and gluconic acid. In the beverage of this invention, said acid can be used to serve as an acidulant. Such an acidulant also includes salts of the aforementioned acids, and specific examples of said salts include trisodium hydrogen citrate and the like. Said acidulant may

also be derived from natural sources such as fruit juice.

[0021] The beverage of the present invention has an acidity of 0.04 to 0.31 g/100 mL. For the purpose of the specification, the acidity is a value serving as an index for acid content, and can be determined by calculation based on the amount of an alkali, such as sodium hydroxide, required for neutralizing a certain amount of a beverage (sample) with said alkali. Acidity measurement can be conducted using, for example, an automatic titrator (*e.g.*, Mettler Toledo DL50). In this invention, the acidity is expressed using a value calculated in terms of citric acid content.

[0022] The acidity of the beverage of the present invention is in the range of 0.04 to 0.31 g/100 mL, and is preferably 0.05 g/100 mL or more, 0.06 g/100 mL or more, 0.07 g/100 mL or more, or 0.08 g/100 mL, and also is preferably 0.25 g/100 mL or less, 0.2 g/100 mL or less, or 0.15 g/100 mL or less. The acidity of the beverage of this invention is in the range of preferably 0.05 to 0.2 g/100 mL, more preferably 0.07 to 0.15 g/100 mL.

[0023] The acidity of the beverage of the present invention may be defined as the total acidity of at least one acid selected from the group consisting of citric acid, malic acid, tartaric acid, phosphoric acid, lactic acid and gluconic acid. In this case, the acidity of the beverage of this invention can be expressed as the acidity derived from at least one acid selected from the group consisting of citric acid, malic acid, tartaric acid, phosphoric acid, lactic acid and gluconic acid. In the beverage of this invention, each one of citric acid, malic acid, tartaric acid, phosphoric acid, lactic acid and gluconic acid can be used alone, or two or more thereof can be used in combination.

[0024] The content of the aforementioned acid is not particularly limited as long as the acidity of the beverage of the present invention falls within the aforementioned range. The content of said acid in the beverage of this invention is for example in the range of 0.1 to 15 g/L. The content of said acid is defined as the total content of at least one acid selected from the group consisting of citric acid, malic acid, tartaric acid, phosphoric acid, lactic acid and gluconic acid. In the case of using citric acid, the content of this acid in the inventive beverage is for example in the range of 0.4 to 3.1 g/L. In the case of using malic acid, the

content of this acid in the inventive beverage is for example in the range of 0.41 to 3.25 g/L. In the case of using tartaric acid, the content of this acid in the inventive beverage is for example in the range of 0.46 to 3.64 g/L. In the case of using phosphoric acid, the content of this acid in the inventive beverage is for example in the range of 0.3 to 2.38 g/L. In the case of using lactic acid, the content of this acid in the inventive beverage is for example in the range of 0.56 to 4.36 g/L. In the case of using gluconic acid, the content of this acid in the inventive beverage is for example in the range of 1.6 to 12.4 g/L.

[0025] The contents of those different acids can be measured by following a method known to skilled artisans -- for example, using HPLC or the like. In the present invention, a commercially available product can be used as said acid.

[0026] (Weight ratio of sugar content to acidity)

In the beverage of the present invention, the content (A) of at least one sugar selected from the group consisting of glucose, fructose and sucrose and the acidity (B) are adjusted at a particular weight ratio. To be specific, the weight ratio of A to B ($[A]/[B]$) is in the range of 16 to 250. The use of the particular sugar(s) and acid(s), and the beverage's acidity, as described above, are important as factors for suppressing the bitterness of caffeine in a colorless transparent beverage, but this weight ratio of sugar content to acidity is also considered to serve an important role in suppression of caffeine's bitterness. It is considered that in this invention, the bitterness of caffeine in a colorless transparent beverage can be effectively suppressed by adjusting said weight ratio to be in the range of 16 to 250. Said weight ratio in the beverage of this invention is preferably 17 or more, 18 or more, 19 or more, 20 or more, 21 or more, 22 or more, 23 or more, 24 or more, 25 or more, 26 or more, 27 or more, 28 or more, 29 or more, or 30 or more, and also is preferably 240 or less, 230 or less, 220 or less, 210 or less, 200 or less, 190 or less, 180 or less, 170 or less, 160 or less, 150 or less, 140 or less, 130 or less, 120 or less, 110 or less, 100 or less, 90 or less, 80 or less, 70 or less, or 60 or less. Said weight ratio in the beverage of this invention is in the range of preferably 17 to 200, more preferably 20 to 200, yet more preferably 25 to 150.

[0027] (Colorless transparent beverage)

The beverage of the present invention is colorless. The colorless appearance of the beverage can be defined by a ΔE (color difference) value of transmitted light as measured relative to pure water using a colorimetric color difference meter (*e.g.*, ZE 2000 (produced by Nippon Denshoku Industries Co., Ltd.)). To be specific, the ΔE value of the beverage of this invention as measured relative to pure water is 3.5 or less. The ΔE value is preferably 2.3 or less.

[0028] Also, the beverage of the present invention is transparent. By stating that “the beverage is transparent”, it is meant that the beverage is not white turbid like so-called sports drinks nor cloudy like cloudy fruit juices, and is visually transparent like water. The transparency of the beverage can be converted to numerical data using a known technique for measuring liquid turbidity. The transparency of the beverage can be defined by absorbance at a wavelength of 660 nm as measured using an ultraviolet visible spectrophotometer (*e.g.*, UV-1600 (produced by Shimadzu Corporation)). To be specific, the beverage of this invention has an absorbance at a wavelength of 660 nm of 0.06 or less. When a beverage is cloudy, the bitterness coming from caffeine becomes harder to feel due to the presence of particles that cause the beverage to be cloudy. On the other hand, when a beverage is transparent, or namely is not cloudy, the bitterness coming from caffeine becomes easier to feel due to the absence of such particles. Therefore, the technique of this invention is useful for colorless transparent beverages.

[0029] (Alcohol)

The beverage of the present invention further comprises an alcohol with 2 or 3 carbon atoms. When an alcohol with 2 or 3 carbon atoms is added to the beverage of this invention, the effect to suppress bitterness coming from caffeine can be further enhanced. The content of an alcohol with 2 or 3 carbon atoms in the beverage of this invention is in the range of 0.001 to 0.5 wt.%. This content is preferably 0.003 wt.% or more, 0.005 wt.% or more, 0.007 wt.% or more, or 0.01 wt.% or more, and also is preferably 0.4 wt.% or less, 0.3 wt.% or less, 0.2 wt.% or less, or 0.1 wt.% or less. The content of an alcohol with 2 or 3 carbon atoms in the beverage of this invention is in the range of preferably 0.005 to 0.4 wt.%,

more preferably 0.01 to 0.1 wt.%. When the content of an alcohol with 2 or 3 carbon atoms falls within the aforementioned range, the bitterness coming from caffeine in the beverage can be suppressed more effectively. If this content exceeds 0.5 wt.%, the peculiar smell and taste coming from an alcohol with 2 or 3 carbon atoms becomes more intense and tends to deteriorate the flavor of the beverage. On the other hand, if this content falls below 0.001 wt.%, the effect of the alcohol with 2 or 3 carbon atoms to suppress caffeine's bitterness may not be fully achieved. Unless otherwise specified, "wt.%" as used herein refers to a percentage by weight/volume (w/v).

[0030] The alcohol with 2 or 3 carbon atoms contained in the beverage of the present invention is not particularly limited, and examples thereof include ethanol, propanol, isopropanol, glycerol, propylene glycol, and the like. In the beverage of this invention, one of those alcohols with 2 or 3 carbon atoms can be used alone, or two or more thereof can be used in combination. When two or more alcohols are used, the aforementioned alcohol content is defined as the total content of those alcohols. The alcohol with 2 or 3 carbon atoms used in the beverage of this invention is preferably ethanol.

[0031] (Non-polymerized catechin compound)

The "non-polymerized catechin compound" refers to a monomeric catechin compound that is not polymerized. Examples of the non-polymerized catechin compound include catechin, galocatechin, catechin gallate (CG), galocatechin gallate (GCG), epicatechin, epigallocatechin, epicatechin gallate (ECG), and epigallocatechin gallate (EGCG).

[0032] The beverage of the present invention may contain a non-polymerized catechin compound. When the beverage of this invention contains a non-polymerized catechin compound, one or more of the compounds belonging to non-polymerized catechin compounds are present in the beverage. The content of a non-polymerized catechin compound in the beverage of this invention is not particularly limited, but is typically not more than 100 mg/100 mL, preferably 0 to 80 mg/100 mL, more preferably 0 to 60 mg/100 mL. If the content of a non-polymerized catechin compound exceeds 100 mg/100 mL, the

beverage tends to become strong in bitter astringency.

[0033] The form in which a non-polymerized catechin compound is used is not particularly limited, and an isolated or purified product of a compound belonging to non-polymerized catechin compounds may be used, or an extract from tea leaves such as oolong tea may be used. The non-polymerized catechin compound may be a commercially available product or a product separately prepared using a known method. The content of a non-polymerized catechin compound can be measured by following a method known to skilled artisans -- for example, using HPLC or the like.

[0034] (Mineral)

The beverage of the present invention preferably contains a mineral, with its type being not particularly limited. When a mineral is added to the beverage of this invention, the effect to suppress bitterness coming from caffeine can be further enhanced. Examples of the mineral include, but are not limited to, sodium, potassium, magnesium, calcium, and iron. Such minerals can be added to the beverage of this invention in the form of salts that can be used in foods and beverages, or in the form of deep ocean water, seaweed essence, or the like which are rich in such minerals. In the beverage of this invention, one of such minerals can be used alone, or two or more thereof can be used in combination. The mineral used in the beverage of this invention is preferably sodium.

[0035] When sodium is used as a mineral, the content of sodium in the beverage of the present invention is not particularly limited, but is for example in the range of 1 to 50 mg/100 mL, preferably 5 to 40 mg/100 mL. When the mineral is used in the form of a salt, the content of the mineral shall be calculated in terms of its free form.

[0036] (Other components)

In addition to the different ingredients described hereinabove, various additives used in common beverages, such as flavorant, enrichment (*e.g.*, vitamin), antioxidant, emulsifier, preservative, essence, dietary fiber, pH adjustor, and quality stabilizer, can be added to the beverage of the present invention, to the extent that such additives do not impair the effects of the present invention.

[0037] The flavorant used in the beverage of the present invention is not particularly limited, but is preferably a flavorant that imparts a natural taste and refreshing flavor to the beverage. Examples of such a flavorant include, but are not limited to, fruit-based flavor, citrus-based flavor, mint-based flavor, coffee flavor, and cocoa flavor.

[0038] The type of the beverage provided by the present invention is not particularly limited, and the inventive beverage can be of any type, including nutritional beverage, functional beverage, flavored water (near water) beverage, and tea beverage (*e.g.*, black tea, oolong tea).

[0039] Also, the beverage of the present invention can be a carbonated beverage or non-carbonated beverage. However, since the effect to suppress bitterness coming from caffeine may diminish in the case of a carbonated beverage, it is preferred that the beverage of this invention be a non-carbonated beverage. Additionally, when the beverage of this invention is provided as a carbonated (*i.e.*, effervescent) beverage, the method for producing a carbonated beverage is not particularly limited, and the carbonated beverage can be produced by fermenting a beverage to produce carbon dioxide in the beverage or by artificially injecting carbon dioxide into a beverage.

[0040] The beverage of the present invention can be a packaged beverage, which is a beverage that is heat sterilized and packed in a package. The package used is not particularly limited, and exemplary packages include PET bottle, aluminum can, steel can, carton, cup for chilled drink, and glass bottle. *Inter alia*, it is preferred to use a colorless transparent package such as PET bottle, since one can see the characteristic colorless transparent appearance of the beverage of this invention while the beverage is packed in such a package. When heat sterilization is performed, the method of heat sterilization is not particularly limited. Heat sterilization can be performed using a common method such as UHT sterilization or retort sterilization. The temperature conditions for heat sterilization process are not particularly limited, and are, for example, 65 to 130°C, preferably 85 to 120°C, for 10 to 40 minutes. However, any other sterilization process can also be performed at an appropriate temperature for several seconds, such as 5 to 30 seconds, as long

as such a process can achieve a comparable sterilizing value to that process under the aforementioned conditions.

[0041] (Beverage production method)

Another aspect of the present invention provides a method for producing a beverage.

[0042] The production method of the present invention is a method for producing a beverage comprising:

0.1 to 60 mg/100 mL of caffeine,

at least one sugar selected from the group consisting of glucose, fructose and sucrose; and

at least one acid selected from the group consisting of citric acid, malic acid, tartaric acid, phosphoric acid, lactic acid and gluconic acid;

wherein the beverage has an absorbance at a wavelength of 660 nm of 0.06 or less;

wherein the beverage has a ΔE (color difference) value of 3.5 or less relative to pure water;

the method comprising the steps of:

adjusting acidity to be in the range of 0.04 to 0.31 g/100 mL;

adjusting a weight ratio of a content of said sugar to said acidity to be in the range of 16 to 250; and

incorporating an alcohol with 2 or 3 carbon atoms in the beverage.

[0043] Various parameters associated with the production method of the present invention, such as the types and contents of the ingredients contained in the beverage are as described above in relation to the beverage of this invention or are obvious from the descriptions given above. The production method of this invention can also comprise the steps of mixing the components and ingredients described above and adjusting their contents. The different steps can be performed simultaneously, separately or in random order. The timings of the different steps can be adjusted as appropriate depending on the state of production.

[0044] In the production method of the present invention, the method and order of mixing ingredients are not particularly limited. Also, the production apparatus used is not

particularly limited. In the production method of this invention, any techniques known to skilled artisans can be used. When the need arises to make the beverage effervescent, a step of injecting carbon dioxide can be added, as appropriate, to the production method of this invention. Further, if necessary, sterilization, packaging, and other steps can be added, as appropriate, to the production method of this invention. In a preferred mode, the beverage of this invention can be made into a packaged beverage through the step of packing the beverage in a package, or can be made into a sterilized, packaged beverage in such a manner as follows. For example, the sterilized, packaged beverage can be produced by taking the step of subjecting a package having a beverage packed therein to heat sterilization such as retort sterilization, or by taking the step of sterilizing a beverage and then packing it in a package.

EXAMPLES

[0045] Hereunder, the present invention will be specifically described in detail by reference to experimental and working examples, but this invention is not limited to these examples.

[0046] (Test Example 1)

Different trial products were prepared by adding caffeine and an emulsified flavor to water so as to ensure that these ingredients were contained in the amounts shown in the table given below. The prepared trial products were measured for their absorbance at a wavelength of 660 nm using a spectrophotometer (UV-1600 (produced by Shimadzu Corporation)).

[0047] The different trial products were rated by 3 panelists on whether the bitterness coming from caffeine was felt. To be specific, the trial products were rated on a six-grade scale from 6 to 1 (6, 5, 4, 3, 2, 1), with "6" being "no bitterness was felt" and "1" being "bitterness was felt". The averages of their ratings are shown in the table given below.

[0048] [Table 1]

	Trial Product 1	Trial Product 2	Trial Product 3
Caffeine (mg/100mL)	5.00	5.00	5.00
Emulsified flavor (g/L)	--	0.250	0.500
Absorbance (660nm)	0.000	0.058	0.119
Sensory rating	1	2	4

[0049] As shown in the above table, it was found that the beverages having an absorbance at a wavelength of 660 nm of 0.06 or less were more apt to make the panelists feel the bitterness of caffeine.

[0050] (Test Example 2)

Different trial products were prepared by adding high-fructose corn syrup, citric acid, and caffeine to water so as to ensure that these ingredients were contained in the amounts shown in the table given below. The prepared trial products all appeared colorless and transparent like water, and showed an absorbance at a wavelength of 660 nm of 0.06 or less as measured by a spectrophotometer (UV-1600 (produced by Shimadzu Corporation)) and a ΔE value of transmitted light of 3.5 or less as measured relative to pure water using a colorimetric color difference meter (ZE 2000 (produced by Nippon Denshoku Industries Co., Ltd.)). The acidity of the trial products was measured using an automatic titrator. Also in subsequent test examples, acidity measurement was done in the same way. The panelists tasted the different trial products and rated them on whether the bitterness coming from caffeine was felt to be suppressed, using the same procedure as in Test Example 1. The averages of their ratings are shown in the table given below.

	Trial Product 4	Trial Product 5	Trial Product 6	Trial Product 7	Trial Product 8	Trial Product 9	Trial Product 10	Trial Product 11	Trial Product 12	Trial Product 13	Trial Product 14	Trial Product 15
Glucose (g/100g)	0.76	0.76	1.52	1.90	3.80	3.80	3.80	6.09	6.09	7.58	7.58	7.58
Fructose (g/100g)	0.24	0.24	0.48	0.60	1.19	1.19	1.19	1.91	1.91	2.38	2.38	2.38
Citric acid (g/L)	0.200	0.400	2.50	1.50	0.400	1.20	3.00	1.20	2.00	0.200	0.400	3.00
Caffeine (mg/100mL)	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
Sugar content (g/100g)	1.00	1.00	2.00	2.50	5.00	5.00	5.00	8.00	8.00	9.97	9.97	9.97
Acidity (g/100mL)	0.020	0.040	0.250	0.150	0.040	0.120	0.300	0.120	0.200	0.020	0.040	0.300
Sugar content/acidity	50	25	8	17	125	42	17	67	40	498	249	33
Sensory rating	2.0	3.7	2.7	3.7	3.7	5.0	3.7	4.7	4.3	3.2	3.7	4.3

[0051] [Table 2]

[0052] As shown in the above table, trial products yielded satisfactory results when they had a weight ratio of sugar content to acidity within the particular range.

[0053] (Test Example 3)

Different trial products were prepared by adding any one of the following sugars: fructose, granulated sugar, glucose, or saccharified starch (containing 12% of glucose and 88% of other sugars than glucose, fructose and sucrose), as well as citric acid and caffeine to water so as to ensure that these ingredients were contained in the amounts shown in the table given below. Trial Products 31 to 34 were prepared using saccharified starch. The prepared trial products all appeared colorless and transparent like water, and showed an absorbance at a wavelength of 660 nm of 0.06 or less as measured by a spectrophotometer (UV-1600 (produced by Shimadzu Corporation)) and a ΔE value of transmitted light of 3.5 or less as measured relative to pure water using a colorimetric color difference meter (ZE 2000 (produced by Nippon Denshoku Industries Co., Ltd.)). The panelists tasted the different trial products and rated them on whether the bitterness coming from caffeine was felt to be suppressed, using the same procedure as in Test Example 1. The averages of their ratings are shown in the table given below.

[0054] [Table 3]

	Trial Product 16	Trial Product 17	Trial Product 18	Trial Product 19	Trial Product 20	Trial Product 21	Trial Product 22	Trial Product 23	Trial Product 24	Trial Product 25
Glucose (g/100g)	--	--	--	--	--	--	--	--	--	--
Fructose (g/100g)	1.00	5.00	5.00	10.00	10.00	--	--	--	--	--
Sucrose (g/100g)	--	--	--	--	--	1.00	5.00	5.00	10.00	10.00
Other sugars (g/100g)	--	--	--	--	--	--	--	--	--	--
Citric acid (g/L)	0.400	1.20	3.00	0.400	3.00	0.400	1.20	3.00	0.400	3.00
Caffeine (mg/100mL)	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
Sugar content (g/100g)	1.00	5.00	5.00	10.00	10.00	1.00	5.00	5.00	10.00	10.00
Acidity (g/100mL)	0.040	0.120	0.300	0.040	0.300	0.040	0.120	0.300	0.040	0.300
Sugar content/acidity	25	42	17	250	33	25	42	17	250	33
Sensory rating	3.5	4.5	4.0	4.2	4.5	3.5	4.2	3.8	4.2	4.3

	Trial Product 26	Trial Product 27	Trial Product 28	Trial Product 29	Trial Product 30	Trial Product 31	Trial Product 32	Trial Product 33	Trial Product 34
Glucose (g/100g)	1.00	5.01	5.01	10.01	10.01	0.12	0.60	0.60	1.19
Fructose (g/100g)	--	--	--	--	--	--	--	--	--
Sucrose (g/100g)	--	--	--	--	--	--	--	--	--
Other sugars (g/100g)	--	--	--	--	--	0.88	4.40	4.40	8.78
Citric acid (g/L)	0.400	1.20	3.00	0.400	3.00	0.400	1.20	3.00	3.00
Caffeine (mg/100mL)	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
Sugar content (g/100g)	1.00	5.01	5.01	10.01	10.01	1.00	5.00	5.00	9.97
Acidity (g/100mL)	0.040	0.120	0.300	0.040	0.300	0.040	0.120	0.300	0.300
Sugar content/acidity	25	42	17	250	33	25	42	17	33
Sensory rating	3.5	4.0	3.8	4.2	4.3	2.5	2.3	2.7	2.8

[0055] As shown in the above table, the trial products prepared using other sugars than saccharified starch yielded satisfactory results.

[0056] (Test Example 4)

Different trial products were prepared by adding any one of the following acids: malic acid, tartaric acid, or phosphoric acid, as well as high-fructose corn syrup and caffeine to water so as to ensure that these ingredients were contained in the amounts shown in the table given below. The prepared trial products all appeared colorless and transparent like water, and showed an absorbance at a wavelength of 660 nm of 0.06 or less as measured by a spectrophotometer (UV-1600 (produced by Shimadzu Corporation)) and a ΔE value of transmitted light of 3.5 or less as measured relative to pure water using a colorimetric color difference meter (ZE 2000 (produced by Nippon Denshoku Industries Co., Ltd.)). The panelists tasted the different trial products and rated them on whether the bitterness coming from caffeine was felt to be suppressed, using the same procedure as in Test Example 1. The averages of their ratings are shown in the table given below.

	Trial Product 35	Trial Product 36	Trial Product 37	Trial Product 38	Trial Product 39	Trial Product 40	Trial Product 41	Trial Product 42	Trial Product 43	Trial Product 44	Trial Product 45	Trial Product 46	Trial Product 47	Trial Product 48	Trial Product 49
Glucose (g/100g)	0.76	3.80	3.80	7.58	7.58	0.76	3.80	3.80	7.58	7.58	0.76	3.80	3.80	7.58	7.58
Fructose (g/100g)	0.24	1.19	1.19	2.38	2.38	0.24	1.19	1.19	2.38	2.38	0.24	1.19	1.19	2.38	2.38
Malic acid (g/L)	0.420	1.26	3.14	0.420	3.14	--	--	--	--	--	--	--	--	--	--
Tartaric acid (g/L)	--	--	--	--	--	0.470	1.41	3.52	0.470	3.52	--	--	--	--	--
Phosphoric acid (g/L)	--	--	--	--	--	--	--	--	--	--	0.310	0.920	2.30	0.310	2.30
Caffeine (mg/100mL)	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
Sugar content (g/100g)	1.00	5.00	5.00	9.97	9.97	1.00	5.00	5.00	9.97	9.97	1.00	5.00	5.00	9.97	9.97
Acidity (g/100mL)	0.040	0.120	0.300	0.040	0.300	0.040	0.120	0.300	0.040	0.300	0.040	0.120	0.300	0.040	0.300
Sugar content/acidity	25	42	17	248	33	25	42	17	248	33	25	42	17	246	33
Sensory rating	3.7	4.5	4.3	4.5	4.3	3.5	4.2	4.0	4.3	4.0	3.5	4.0	3.8	4.3	4.0

[0057] [Table 4]

[0058] As shown in the above table, even the trial products prepared using malic acid, tartaric acid, or phosphoric acid yielded satisfactory results comparable to those prepared with citric acid.

[0059] (Test Example 5)

Different trial products were prepared by adding any one of the following acids: lactic acid, gluconic acid, or acetic acid, as well as high-fructose corn syrup and caffeine to water so as to ensure that these ingredients were contained in the amounts shown in the table given below. The prepared trial products all appeared colorless and transparent like water, and showed an absorbance at a wavelength of 660 nm of 0.06 or less as measured by a spectrophotometer (UV-1600 (produced by Shimadzu Corporation)) and a ΔE value of transmitted light of 3.5 or less as measured relative to pure water using a colorimetric color difference meter (ZE 2000 (produced by Nippon Denshoku Industries Co., Ltd.)). The panelists tasted the different trial products and rated them on whether the bitterness coming from caffeine was felt to be suppressed, using the same procedure as in Test Example 1. The averages of their ratings are shown in the table given below.

	Trial Product 50	Trial Product 51	Trial Product 52	Trial Product 53	Trial Product 54	Trial Product 55	Trial Product 56	Trial Product 57	Trial Product 58	Trial Product 59	Trial Product 60	Trial Product 61	Trial Product 62	Trial Product 63	Trial Product 64
Glucose (g/100g)	0.76	3.80	3.80	7.58	7.58	0.76	3.80	3.80	7.58	7.58	0.76	3.80	3.80	7.58	7.58
Fructose (g/100g)	0.24	1.19	1.19	2.38	2.38	0.24	1.19	1.19	2.38	2.38	0.24	1.19	1.19	2.38	2.38
Lactic acid (g/L)	0.565	1.69	4.22	0.565	4.22	--	--	--	--	--	--	--	--	--	--
Gluconic acid (g/L)	--	--	--	--	--	1.60	4.80	12.0	1.60	12.0	--	--	--	--	--
Acetic acid (g/L)	--	--	--	--	--	--	--	--	--	--	0.387	1.15	2.89	0.387	2.89
Caffeine (mg/100mL)	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
Sugar content (g/100g)	1.00	5.00	5.00	9.97	9.97	1.00	5.00	5.00	9.97	9.97	1.00	5.00	5.00	9.97	9.97
Acidity (g/100mL)	0.040	0.120	0.300	0.040	0.300	0.040	0.120	0.300	0.040	0.300	0.040	0.120	0.301	0.040	0.301
Sugar content/acidity	25	42	17	248	33	25	42	17	249	33	25	42	17	248	33
Sensory rating	3.5	4.0	4.0	4.5	4.3	3.5	4.0	4.0	4.3	4.0	2.3	2.8	2.7	2.7	3.0

[0060] [Table 5]

[0061] As shown in the above table, the trial products prepared using the other acids than acetic acid yielded satisfactory results comparable to those prepared with citric acid.

[0062] (Test Example 6)

Different trial products were prepared by adding high-fructose corn syrup, citric acid, caffeine and common salt to water so as to ensure that these ingredients were contained in the amounts shown in the table given below. The prepared trial products all appeared colorless and transparent like water, and showed an absorbance at a wavelength of 660 nm of 0.06 or less as measured by a spectrophotometer (UV-1600 (produced by Shimadzu Corporation)) and a ΔE value of transmitted light of 3.5 or less as measured relative to pure water using a colorimetric color difference meter (ZE 2000 (produced by Nippon Denshoku Industries Co., Ltd.)). The panelists tasted the different trial products and rated them on whether the bitterness coming from caffeine was felt to be suppressed, using the same procedure as in Test Example 1. The averages of their ratings are shown in the table given below.

[0063] [Table 6]

	Trial Product 65	Trial Product 66	Trial Product 67	Trial Product 68	Trial Product 69
Glucose (g/100g)	3.80	3.80	3.80	3.80	3.80
Fructose (g/100g)	1.19	1.19	1.19	1.19	1.19
Citric acid (g/L)	1.20	1.20	1.20	1.20	1.20
Caffeine (mg/100mL)	10.0	10.0	10.0	10.0	10.0
Sodium (mg/100mL)	--	5.0	10.0	20.0	40.1
Sugar content (g/100g)	5.00	5.00	5.00	5.00	5.00
Acidity (g/100mL)	0.120	0.120	0.120	0.120	0.120
Sugar content/acidity	42	42	42	42	42
Sensory rating	5	5.3	5.3	5.8	5.8

[0064] As shown in the above table, addition of sodium to trial products produced satisfactory results with respect to suppression of caffeine's bitterness.

[0065] (Test Example 7)

Different trial products were prepared by adding any one of the following alcohols: ethanol, glycerol, propylene glycol or butanol, as well as high-fructose corn syrup, citric acid, and caffeine to water so as to ensure that these ingredients were contained in the amounts

shown in the table given below. The prepared trial products all appeared colorless and transparent like water, and showed an absorbance at a wavelength of 660 nm of 0.06 or less as measured by a spectrophotometer (UV-1600 (produced by Shimadzu Corporation)) and a ΔE value of transmitted light of 3.5 or less as measured relative to pure water using a colorimetric color difference meter (ZE 2000 (produced by Nippon Denshoku Industries Co., Ltd.)). The panelists tasted the different trial products and rated them on whether the bitterness coming from caffeine was felt to be suppressed, using the same procedure as in Test Example 1. The averages of their ratings are shown in the table given below.

	Trial Product 70	Trial Product 71	Trial Product 72	Trial Product 73	Trial Product 74	Trial Product 75	Trial Product 76	Trial Product 77	Trial Product 78	Trial Product 79	Trial Product 80	Trial Product 81	Trial Product 82	Trial Product 83
Glucose (g/100g)	0.76	3.80	3.80	3.80	3.80	3.80	3.80	3.80	3.80	3.80	3.80	3.80	3.80	3.80
Fructose (g/100g)	0.24	1.19	1.19	1.19	1.19	1.19	1.19	1.19	1.19	1.19	1.19	1.19	1.19	1.19
Citric acid (g/L)	0.200	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20
Ethanol (%)	--	--	0.001	0.005	0.100	--	--	--	--	--	--	--	--	--
Glycerol (%)	--	--	--	--	--	0.001	0.005	0.100	--	--	--	--	--	--
Propylene glycol (%)	--	--	--	--	--	--	--	--	0.001	0.005	0.100	--	--	--
Butanol (%)	--	--	--	--	--	--	--	--	--	--	--	0.001	0.005	0.100
Caffeine (mg/100mL)	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
Sugar content (g/100g)	1.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00
Acidity (g/100mL)	0.020	0.120	0.120	0.120	0.120	0.120	0.120	0.120	0.120	0.120	0.120	0.120	0.120	0.120
Sugar content/acidity	50	42	42	42	42	42	42	42	42	42	42	42	42	42
Sensory rating	2	5	5.7	5.7	5.8	5.5	5.7	5.8	5.5	5.5	6	5	5	5

[0066] [Table 7]

[0067] As shown in the above table, the trial products having ethanol, glycerol or propylene glycol added thereto yielded superior results with respect to suppression of caffeine's bitterness when compared to those with no such alcohol added thereto.

[0068] (Test Example 8)

Different trial products were prepared by adding high-fructose corn syrup, citric acid, and caffeine to water so as to ensure that these ingredients were contained in the amounts shown in the table given below. The prepared trial products all appeared colorless and transparent like water, and showed an absorbance at a wavelength of 660 nm of 0.06 or less as measured by a spectrophotometer (UV-1600 (produced by Shimadzu Corporation)) and a ΔE value of transmitted light of 3.5 or less as measured relative to pure water using a colorimetric color difference meter (ZE 2000 (produced by Nippon Denshoku Industries Co., Ltd.)). The panelists tasted the different trial products and rated them on whether the bitterness coming from caffeine was felt to be suppressed, using the same procedure as in Test Example 1. The averages of their ratings are shown in the table given below.

[0069] [Table 8]

	Trial Product 84	Trial Product 85	Trial Product 86	Trial Product 87	Trial Product 88	Trial Product 89	Trial Product 90	Trial Product 91
Glucose (g/100g)	0.76	3.80	0.76	3.80	0.76	3.80	0.76	3.80
Fructose (g/100g)	0.24	1.19	0.24	1.19	0.24	1.19	0.24	1.19
Lactic acid (g/L)	0.200	1.20	0.200	1.20	0.200	1.20	0.200	1.20
Caffeine (mg/100mL)	1.00	1.00	20.0	20.0	30.0	30.0	40.0	40.0
Sugar content (g/100g)	1.00	5.00	1.00	5.00	1.00	5.00	1.00	5.00
Acidity (g/100mL)	0.020	0.120	0.020	0.120	0.020	0.120	0.020	0.120
Sugar content/acidity	50	42	50	42	50	42	50	42
Sensory rating	2.7	5	2	4.3	1.2	4.2	1	3.5

[0070] As shown in the above table, it was found that when trial products having particular ranges of acidity and weight ratio of sugar content to acidity contained caffeine in an amount within the specified range, they produced satisfactory results.

CLAIMS

1. A beverage comprising:

0.1 to 60 mg/100 mL of caffeine;

at least one sugar selected from the group consisting of glucose, fructose and sucrose; and

at least one acid selected from the group consisting of citric acid, malic acid, tartaric acid, phosphoric acid, lactic acid and gluconic acid;

wherein the beverage has an acidity of 0.04 to 0.31 g/100 mL;

wherein the beverage has a weight ratio of a content of said sugar to said acidity of 16 to 250;

wherein the beverage contains 0.001 to 0.5 wt.% of an alcohol with 2 or 3 carbon atoms;

wherein the beverage has an absorbance at a wavelength of 660 nm of 0.06 or less;

and

wherein the beverage has a ΔE (color difference) value of 3.5 or less relative to pure water.

2. The beverage according to claim 1, wherein the beverage is a packaged beverage.

3. A method for producing a beverage comprising:

0.1 to 60 mg/100 mL of caffeine;

at least one sugar selected from the group consisting of glucose, fructose and sucrose; and

at least one acid selected from the group consisting of citric acid, malic acid, tartaric acid, phosphoric acid, lactic acid and gluconic acid;

wherein the beverage has an absorbance at a wavelength of 660 nm of 0.06 or less;

wherein the beverage has a ΔE (color difference) value of 3.5 or less relative to pure

water;

the method comprising the steps of:

adjusting acidity to be in the range of 0.04 to 0.31 g/100 mL;

adjusting a weight ratio of a content of said sugar to said acidity to be in the range of 16 to 250; and

adding an alcohol with 2 or 3 carbon atoms to the beverage.