

DESCRIPTION

PACKAGED BEVERAGE

TECHNICAL FIELD

[0001] The present invention relates to a packaged beverage and a method for producing the same. In particular, this invention relates to a packaged beverage that can retain a just-made, fresh quality of aroma characteristic of a beverage of interest, and a method for producing the same.

BACKGROUND ART

[0002] Packaged beverages are widely distributed and consumed beverages mainly packed in cans, glass bottles, PET bottles, cups for chilled drinks, and the like. However, some types of packaged beverages are produced through heat sterilization for the purpose of making them durable for long-term distribution and storage -- in some cases, aroma components are reduced by heat sterilization or are deteriorated during storage or distribution, so that a just-made, fresh aroma characteristic of beverages may become difficult to feel upon drinking.

[0003] There have hitherto been proposed various techniques for enhancing the aroma of a packaged beverage. To cite some examples, PTL 1 discloses that the deterioration of a packaged beverage over time can be reduced by adjusting the amount of dissolved oxygen in solution to be in the range of 0.1 to 3.0 ppm in a primary heating-deoxygenation step. PTL 2 discloses that a dripped coffee beverage with excellent long-term storability can be obtained through the use of coffee beans pretreated with steam at a specified temperature. Further, there have been some suggestions from the viewpoint of package. For example, PTL 3 suggests that a beverage package suitable for long-term storage can be obtained by forming a multilayered resin beverage package by stacking an oxygen absorbing layer and an oxygen barrier layer. PTL 4 suggests that a beverage package suitable for storage in package can be obtained by enhancing the optical transparency of the package.

[0004] In general, it is considered that the deterioration of an aroma component of a beverage over time is typically caused by, for example, oxidation due to dissolved oxygen or oxygen permeated through a packaging material, or deterioration due to light-generated radicals. With regard to coffee beverages, it has been reported, for example, that coffee aroma components are inactivated in the coexistence of coffee melanoidins (NPL 1).

CITATION LIST

PATENT LITERATURES

- [0005] PTL 1: Japanese Unexamined Patent Application Publication No. JP 2015-208303
PTL 2: Japanese Unexamined Patent Application Publication No. JP 2004-049086
PTL 3: International Patent Publication No. WO 2016/027577
PTL 4: Japanese Unexamined Patent Application Publication No. JP H08-34910

NON PATENT LITERATURE

- [0006] NPL 1: *Journal of Agricultural and Food Chemistry*, 2002, 50, pages 319-326

SUMMARY OF INVENTION

TECHNICAL PROBLEM

[0007] There have hitherto been proposed various techniques for addressing the deterioration in the quality of aroma of a packaged beverage due to heat and over time, but the problems are yet to be fully solved. In view of these circumstances, an object of the present invention is to develop a technique for reducing the deterioration in the quality of aroma of a packaged beverage due to heat and over time.

SOLUTION TO PROBLEM

[0008] As a result of conducting intensive studies to achieve the aforementioned object, the present inventors found that when nonanal which is a component that imparts a characteristic aroma of a tea beverage, or sulfur-containing volatile compounds (also called “sulfur-containing aroma components”) which impart a characteristic aroma of coffee, are spatially separated from catechins present in a tea beverage, or polyphenols like chlorogenic acid present in coffee, and the total polyphenols concentration in one beverage composition packed in one beverage storage segment is adjusted to be higher than that in a different

beverage composition packed in a different beverage storage segment, the deterioration in the aroma of tea or coffee due to heat and over time can be effectively reduced.

[0009] The present invention includes, but is not limited to, the following embodiments.

- (1) A packaged coffee beverage or packaged tea beverage comprising two or more beverage compositions that differ in the compositional profile of components and are each packed separately in two or more beverage storage segments, wherein the total polyphenols concentration in one beverage composition packed in one beverage storage segment is higher than that in a different beverage composition packed in a different beverage storage segment.
- (2) The beverage as set forth in (1), wherein the beverage is a concentrated-type beverage that is drunk after the two or more beverage compositions packed in the beverage storage segments are diluted.
- (3) The beverage as set forth in (1) or (2), wherein the beverage is drunk after the two or more beverage compositions packed in the beverage storage segments are mixed together.
- (4) The beverage as set forth in any of (1) to (3), wherein the package is a package having two beverage storage segments.
- (5) The beverage as set forth in any of (1) to (4), wherein the beverage is a packaged coffee beverage in which the concentration of a sulfur-containing aroma component in one beverage composition packed in one beverage storage segment is lower than that in a different beverage composition packed in a different beverage storage segment.
- (6) The beverage as set forth in any of (1) to (5), wherein the beverage is a packaged coffee beverage in which the concentration of a sulfur-containing aroma component in a composition into which the beverage compositions packed in the two or more beverage storage segments are mixed together after they are each separately sterilized is higher than that in a composition that is sterilized after the beverage compositions are mixed together.
- (7) The beverage as set forth in any of (1) to (4), wherein the beverage is a packaged tea beverage in which the nonanal concentration in one beverage composition packed in one beverage storage segment is lower than that in a different beverage composition packed in a different beverage storage segment.

(8) The beverage as set forth in any of (1) to (4) and (7), wherein the beverage is a packaged tea beverage in which the nonanal concentration in a composition into which the beverage compositions packed in the two or more beverage storage segments are mixed together after they are each separately sterilized is higher than that in a composition that is sterilized after the beverage compositions are mixed together.

(9) A method for producing the beverage as set forth in any of (1) to (8), the method comprising a step of packing two or more beverage compositions that differ in compositional profile separately in two or more beverage storage segments.

ADVANTAGEOUS EFFECTS OF INVENTION

[0010] According to the present invention, the deterioration in the quality of aroma of a packaged beverage due to heat and over time can be reduced effectively, unlike in conventional packaged beverages. In particular, according to this invention, it becomes easy for a beverage of interest to retain its characteristic aroma, and therefore, the added value of a packaged beverage can be increased.

[0011] Further, according to the present invention, it is possible to reduce the deterioration in the quality of aroma of a beverage due to heat sterilization during production and due to deterioration over time during storage and distribution, and therefore, it can be expected that elimination of aroma components in a beverage is reduced, thereby leading to improvement in material yield.

DESCRIPTION OF EMBODIMENTS

[0012] The packaged beverage of the present invention is a packaged beverage comprising two or more beverage compositions that differ in compositional profile and are each packed separately in two or more beverage storage segments, wherein the total polyphenols concentration in one beverage composition packed in one beverage storage segment is higher than that in a different beverage composition packed in a different beverage storage segment.

[0013] Packaged beverage

The beverage of the present invention is a beverage packed in a package. In this invention, a package having two or more beverage storage segments is used. The number of

beverage storage segments is not particularly limited as long as there are two or more, but the number of beverage storage segments is preferably not more than four, more preferably not more than three, still more preferably two. The packaged beverage of this invention is a beverage in which two or more beverage compositions that differ in compositional profile and are each packed in separate beverage storage segments -- by adopting such a configuration, the deterioration in aroma of a beverage over time can be reduced. The volume of each beverage storage segment is not particularly limited, and can be, for example, in the range of 1 to 100 mL, preferably 2 to 60 mL, more preferably 3 to 50 mL, still more preferably 4 to 40 mL, or may be in the range of 5 to 30 mL. The volumes of respective beverage storage segments can be the same or different.

[0014] In a preferred embodiment, the packaged beverage of the present invention is drunk after two or more beverage compositions packed in beverage storage segments are mixed together. In another preferred embodiment, the packaged beverage of this invention is drunk after two or more beverage compositions packed in beverage storage segments are diluted -- in this case, the beverage compositions packed in beverage storage segments are typically concentrated(-type) beverages. For dilution of a beverage, not only water but also carbonated water, an aqueous alcohol (ethanol) solution, and milk can be suitably used. For example, when a packaged tea beverage is diluted using milk as a diluting liquid, the beverage can be drunk as a tea with milk or the like. The same is true for a packaged coffee beverage. The dilution factor used to dilute the packaged beverage of this invention with a diluent is not particularly limited, but is preferably in the range of 2.0 to 20.0-fold, more preferably 3.0 to 10.0-fold, still more preferably 4.0 to 8.0-fold.

[0015] When the packaged beverage of the present invention is drunk after mixing and/or dilution, it is preferred to transfer the packaged beverage to a separate container before drinking it. The packaged beverage of this invention is characterized in that beverage compositions are mixed together after heating. As compared to a beverage heated after beverage compositions are mixed together, the beverage of this invention can retain its just-made, fresh aroma and a characteristic aroma of the beverage of interest, even after long-term

storage at ordinary temperatures.

[0016] The material type, shape, and the like of the package used in the present invention are not particularly limited as long as the package has at least two beverage storage segments. With regard to package material type, the package can be of any material type commonly used in beverage packages -- for example, metal packages such as aluminum and steel cans, resin packages such as PET bottle, glass bottles, and paper packages. In a particularly preferred embodiment, the package of the beverage of this invention is a resin package.

[0017] In the process of producing the packaged beverage of the present invention, beverage compositions may be packed in a package after they are heat sterilized, or beverage compositions may be heat sterilized after they are packaged. Also, in this invention, aseptic packaging at low temperatures, etc. may be performed. The conditions for heat sterilization are not particularly limited, and the treatment should only be performed as stipulated in the Food Sanitation Act of Japan. For example, in the case of canned beverages, retort sterilization (*e.g.*, heat sterilization at 121°C for 7 minutes while pressure is added as appropriate) should be performed, and in the case of beverages packed in resin packages, UHT sterilization (*e.g.*, sterilization of a beverage composition by holding it at 120 to 150°C for one to several tens of seconds) should be performed. If necessary, hot-pack filling, film sterilization, or the like may also be used. For example, retort sterilization can be performed under the conditions of about 110 to 130°C for about 10 to 30 minutes, preferably about 120 to 125°C for about 10 to 20 minutes, and UHT sterilization can be performed under the conditions of about 120 to 150°C for about 1 to 120 seconds, preferably about 130 to 145°C for 30 to 120 seconds. In the process of producing the packaged beverage of this invention, a sterilization step is preferably performed individually for each beverage composition to be packed in each beverage storage segment, in order to prevent unintended mixture or contamination prior to packaging. By performing treatment in such a manner, deterioration in aroma prior to a packaging step can be minimized.

[0018] The packaged beverage of the present invention can be produced by a production process comprising, for example, a step of preparing two or more beverage compositions, and

a step of packing each of the prepared two or more beverage compositions in separate beverage storage segments. Also, the order of steps may be changed, or a new step may be added as appropriate -- for example, a sterilization step may be added or a step of removing unwanted residues, etc. by filtration, etc. may be inserted.

[0019] In the packaged beverage of the present invention, at least two beverage compositions are packed and differ from each other in compositional profile. As referred to in this invention, the “beverage composition” refers to a liquid composition prepared for drinking purpose. For preparation of a beverage composition, any given known mixing apparatuses can be used freely, such as paddle mixer, homo-mixer, or optionally high-pressure homo-mixer. Examples of ingredients that can be contained in beverage compositions include: common beverage ingredients such as coffee extract, tea extract, fruit extract, and vegetable extract; synthetic and natural flavorants; sugars; sweeteners; seasonings; antioxidants; thickeners; emulsifiers; pH adjustors; and alcohols such as liqueur. If necessary, a solid or semi-solid product such as fruit pulp or other pulp, or jelly may be dispersed.

[0020] In general, nonanal which is a component that imparts a characteristic aroma of a tea beverage, and sulfur-containing volatile compounds which impart a characteristic aroma of coffee, have a tendency to deteriorate easily due to heat and over time. Further, when reacted with polyphenols, etc., those components tend to be more liable to deterioration. Thus, in the present invention, coffee melanoidins (also called “chlorogenic acids” or “brown components”) in the case of coffee, or catechins and tannic acid in the case of a tea extract, and aroma components are each biasedly distributed in separate beverage compositions (which means that the concentration of certain components in one beverage composition is made higher than that in other beverage compositions), and the separate beverage compositions are stored in isolation from each other, whereby a decrease in aroma components can be minimized and the deterioration in aroma due to heat and over time can be effectively reduced.

[0021] When two or more beverage compositions are each packed separately in two or more beverage storage segments so that polyphenols are biasedly distributed in one beverage composition whereas the concentration of sulfur-containing compounds such as thiols and sulfides, or the concentration of aldehydes such as short-chain fatty aldehydes and terpene aldehydes, is made high in a different beverage composition in which polyphenols are not biasedly distributed -- in other words, when easy-to-deteriorate components are distributed in larger amounts in one of the two or more beverage compositions which is lower in components that promote deterioration --, the aroma deterioration reducing effects of the present invention can be particularly significantly exhibited.

[0022] Examples of aroma components include not only components that mainly affect aroma but also components that mainly affect taste. In addition, for example, components that are highly reactive and susceptible to deterioration and denaturation are preferably biasedly distributed in one beverage composition. Antioxidative components such as astaxanthin, tocopherols and vitamin C, and various pigment components may be biasedly distributed in one beverage composition, but may also be present in two or more beverage compositions.

[0023] In the present invention, the total polyphenols concentration in at least one beverage composition packed in at least one beverage storage segment is adjusted to be higher than that in a different beverage composition packed in a different beverage storage segment. In a preferred embodiment, the total polyphenols concentration in one beverage composition packed in one beverage storage segment is preferably at least 1.2 times, or may be at least 1.5 times or at least 1.8 times, higher than that in a different beverage composition packed in a different beverage storage segment. The upper limit of said total polyphenols concentration is not particularly limited.

[0024] Packaged coffee beverage

In a preferred embodiment of the present invention, the packaged beverage of this invention can be a packaged coffee beverage in which at least one beverage composition comprises a coffee extract. In this embodiment, the total polyphenols concentration in one

beverage composition packed in one beverage storage segment is higher than that in a different beverage composition packed in a different beverage storage segment. As referred to above, the “coffee extract” refers to an extract from roasted coffee beans, and also includes a product processed in a powder form by drying a liquid coffee extract.

[0025] The type of roasted coffee beans used as an ingredient to obtain a liquid coffee extract in the present invention is not particularly limited. The roasted coffee beans can be finished to an appropriate degree of roast depending on the intended purpose, by such a roasting method as direct roasting, hot-air roasting, semi-hot-air roasting, charcoal fire roasting, far-infrared ray roasting, microwave roasting, or superheated steam roasting, with the use of such a roasting machine as horizontal drum roaster, vertical drum roaster, vertical rotary ball roaster, fluid bed roaster, or pressurized roaster. In one of preferred embodiments, it is advantageous to use coffee beans roasted to ensure that the indicative value as measured by an Agtron color meter (Agtron value) is approximately in the range of 35 to 60, preferably 45 to 50. The variety of coffee beans is also not limited, and various coffee varieties including *arabica* and *robusta* can be used. The liquid coffee extract can be obtained by extracting the aforementioned roasted coffee beans with a water-soluble solvent like warm water by a conventional method.

[0026] As referred to herein, the “coffee beverage” refers to a beverage product produced using a coffee matter as an ingredient. The product type of the coffee beverage is not particularly limited, and typical examples thereof include “coffee”, “coffee drinks” and “coffee-containing soft drinks” as defined in the “Fair Competition Code for Labeling of Coffee Drinks” certified in 1977. Among beverage products produced using a coffee matter as an ingredient, those with a milk solids content of 3.0 mass% or more are covered by the application of the “Fair Competition Code for Labeling of Drinking Milk” and handled as “milk beverages”. Such beverage products are also included in the scope of the coffee beverage of this invention.

[0027] As referred to above, the “coffee matter” refers to a solution containing components derived from coffee beans, and is exemplified by a liquid coffee extract -- *i.e.*, a solution

extracted from roasted and ground coffee beans with water, warm water or the like. Other examples of a coffee matter include a coffee essence obtained by concentrating a liquid coffee extract, and a solution prepared by adjusting instant coffee made from a dried coffee extract to an adequate volume with the addition of water, warm water or the like.

[0028] One of elements that characterize coffee-like aroma is roast aroma. The “coffee-like roast aroma” refers to the fresh-roasted aroma of coffee, which means roasted aroma passing from the oral cavity through the nasal cavity at the time of drinking coffee.

Components that contribute to coffee roast aroma include sulfur-containing volatile compounds such as 3-mercapto-3-methylbutyl formate and 2-furfurylthiol. Further, coffee contains polyphenols such as chlorogenic acid. Polyphenols have the property to cause deterioration of sulfur-containing aroma components (*e.g.*, 3-mercapto-3-methylbutyl formate); thus, when the total polyphenols content is high, deterioration of sulfur-containing aroma components is promoted.

[0029] The packaged beverage of the present invention may contain caffeine. In some beverages such as coffee beverages, the presence of caffeine is considered important from the viewpoint of flavor. However, when the caffeine content is too high, the aroma of a beverage may be deteriorated. In a preferred embodiment, the lower limit of caffeine content in the inventive beverage is preferably 10 mg, more preferably 15 mg, still more preferably 20 mg, yet more preferably 25 mg, particularly more preferably 30 mg, based on 100 mL of the beverage. The upper limit of caffeine content is preferably 100 mg, more preferably 95 mg, still more preferably 90 mg, yet more preferably 85 mg, particularly more preferably 80 mg.

[0030] Roasted coffee beans can also be used in a ground form. The grinding treatment is performed within 24 hours, preferably within 20 hours, more preferably within 15 hours, particularly preferably within 10 hours after the roasting treatment. When roasted coffee beans are left untreated for a long time after the roasting treatment, oil and fat components are more likely to be deposited on the surface of the coffee beans. In the process of dry grinding treatment, it is preferred that roasted coffee beans be subjected to coarse grinding to

a median size of 1 mm or less, followed by fine grinding. Performing coarse grinding as a preliminary step before fine grinding enables fine grinding to be performed more efficiently in a shorter time, thereby minimizing scattering of coffee aroma (flavor). Also, adopting coarse grinding gives another advantage in that the particle size distribution of the ground powder can be narrowed. The coarse grinding treatment is performed so as to obtain a median size of approximately 1 mm or less, preferably 0.5 mm or less, but the method of coarse grinding is not particularly limited. Various types of mills including roll mill, ball mill and stone mill can be used.

[0031] The degree of fine grinding of roasted coffee beans can be controlled by their median size. The lower limit of median value can be preferably 50 μm , more preferably 70 μm , more preferably 80 μm , still more preferably 90 μm . In a preferred embodiment, coffee beans can be finely ground so as to obtain a finely ground powder having a median particle size value of 300 μm or less, more preferably 250 μm or less, still more preferably 200 μm or less. A powder finely ground to a median size of more than 300 μm may give a feeling of strangeness in terms of textures, such as feeling of eating and feeling on the tongue. In contrast, when coffee beans are ground to an excessively fine size, there is a tendency that the storage stabilization effect of the present invention cannot be obtained. The method of fine grinding is also not particularly limited, and various types of mills including roll mill, impact mills with a bar hammer or a pin hammer, and jet mill can be used, with a roll mill being preferably used.

[0032] Particle size is generally represented by expressing the particle size measurements of large numbers of particles as a distribution of the relative proportions of particles present according to size -- this distribution is called particle size distribution. The basis of the relative proportions of particles present can be exemplified by volume basis, number basis, and the like. As used herein, the relative proportions of particles present are expressed on a volume basis, and can be measured by an analyzer based on laser diffraction and light scattering. Examples of such an analyzer include a Microtrac particle size distribution analyzer (produced by Nikkiso Co., Ltd.). Further, as referred to herein, the particle size of

a finely ground powder of roasted coffee beans is expressed as a median size. The median size refers to a size corresponding to a value at 50% of the cumulative particle size distribution. There is a particular particle size by which a powder can be divided into two portions which are respectively composed in equal amounts of grains with a larger size or grains with a smaller size -- such a particle size is called median size.

[0033] Packaged tea beverage

In a preferred embodiment of the present invention, the packaged beverage of this invention can be a packaged tea beverage in which at least one beverage composition comprises a tea extract. In this embodiment, the total polyphenols concentration in one beverage composition packed in one beverage storage segment is higher than that in a different beverage composition packed in a different beverage storage segment. As referred to above, the “tea extract” refers to an extract from tea leaves, and also includes a powder processed in a powder form by drying a liquid tea leaf extract.

[0034] In the present invention, the tea leaf extract is an extract obtained by, for example, soaking tea leaves in an extraction solvent to extract components present in the tea leaves. The method of extraction is not particularly limited, and any known technique can be selected, such as extraction by soaking in an extraction solvent. As the extraction solvent, hot water, cold water, or any specified organic solvent can be selected, but the extraction solvent is preferred to be water from the viewpoint of use in beverages. During the process of extraction, various treatments such as compression, filtration and centrifugation may be performed depending on the need.

[0035] In this embodiment, the tea extract can be in the form of an extraction solvent in which components present in a plant are extracted, or in the form of a solid matter composed of extracted components collected by concentrating or drying such an extraction solvent depending on the need. Further, the plant may be in the form of a processed plant product prepared through the steps of cutting, heating, drying and the like depending on the need.

[0036] One of aromas that characterize fresh aroma of tea is “gourd-like aroma”. The gourd-like aroma is an aroma characteristic of the high-grade green tea *Gyokuro*. Aroma

components responsible for the gourd-like aroma are exemplified by nonanal, disulfides and the like, and are contained in larger amounts in first harvest tea leaves of higher grades.

First harvest tea leaves of high grades are also rich in leaf alcohol and the like, which are considered to be responsible for the aroma of first harvest tea leaves. Further, tea beverages contain polyphenols such as catechins. Polyphenols have the property to cause deterioration of aroma components such as nonanal; thus, when the total polyphenols content is high, deterioration of aroma components is promoted.

[0037] The variety of tea leaves is not particularly limited, and any tea leaves of a tree of tea (*Camellia sinensis*) can be advantageously selected. Tea leaves can be raw tea leaves, but such tea leaves as listed below can also be used: *Ara-cha* (crude tea) tea leaves which are processed through the so-called *Ara-cha* processing steps such as heating raw leaves by steaming, roasting, etc., and rolling tea leaves; *Sen-cha* tea leaves which are obtained by subjecting *Ara-cha* tea leaves to a further finishing step; refined tea leaves (finished tea leaves) such as *Gyokuro*; semi-fermented tea leaves such as oolong tea leaves; and fermented tea leaves such as black tea leaves.

[0038] In this embodiment, when the tea extract is liquid, the extract can be used as it is as a beverage composition. Also, use can be made of a solution obtained by dissolving a concentrated form or dried solid matter of tea extract again in a solvent such as water to a specified concentration. The beverage compositions can incorporate not only a tea extract but also different additives as described below.

[0039] Also in the case of the “tea beverage” as referred to herein, among beverage products produced using tea as an ingredient, those with a milk solids content of 3.0 mass% or more are covered by the application of the “Fair Competition Code for Labeling of Drinking Milk” and handled as “milk beverages”. Such beverage products are also included in the scope of the tea beverage of the present invention.

[0040] (Carbon dioxide gas)

The packaged beverage of the present invention may be a carbonated beverage in which carbon dioxide gas is present at the time of drinking. The pressure of carbon dioxide

gas is preferably adjusted to such a level that a refreshing sensation coming from carbon dioxide gas can be perceived, and is preferably in the range of 0.5 to 4.5 kgf/cm², more preferably 1.0 to 4.0 kgf/cm², still more preferably 1.5 to 3.5 kgf/cm², at a liquid temperature of 20°C. In a preferred embodiment, the packaged beverage of this invention can be diluted with carbonated water into a carbonated beverage after its package is opened.

[0041] (Milk)

In a preferred embodiment, the packaged beverage of the present invention can be drunk as a beverage containing oil and fat components such as milk fat and vegetable oil and fat. Incorporation of milk components to a beverage not only imparts a milk flavor and texture to the beverage, but also makes the mouthfeel of the beverage milder and smoothens irritation to the stomach.

[0042] In general, milk-containing beverages are preferred to contain both milk fat and solid-non-fat components. Recently, from the viewpoints of the stability, price and the like of milk fat, there are also developed beverages in which part or the whole of milk fat is replaced by vegetable oil and fat. In this invention, the “milk-containing beverage” refers to a beverage produced using solid-non-fat components and milk fat and/or vegetable oil and fat as some of ingredients. As referred to in relation to a milk-containing beverage, the “milk” refers to a component added to impart a milk flavor and texture to a beverage. Examples of an ingredient that supplies a solid-non-fat component include, but are not limited to, raw milk, pasteurized milk, certified milk, partially defatted milk, processed milk, cream, concentrated milk, unsweetened condensed milk, whole powdered milk, cream powder, butter milk powder, modified powdered milk, defatted milk, concentrated whey, defatted concentrated milk, sweetened defatted concentrated milk, defatted powdered milk, and whey powder. Examples of an ingredient that supplies milk fat include, but are not limited to, raw milk, pasteurized milk, certified milk, partially defatted milk, processed milk, cream, concentrated milk, unsweetened condensed milk, whole powdered milk, cream powder, butter milk powder, and modified powdered milk. Milk fat may be partially or wholly replaced by vegetable oil and fat. Examples of vegetable oil and fat include, but are not

limited to, vegetable oils such as rapeseed oil, hardened rapeseed oil, rice oil, soybean oil, corn oil, safflower oil, sunflower oil, cotton seed oil, sesame oil, olive oil, palm oil, palm kernel oil, coconut oil and coconut kernel oil, hydrogenated oils thereof, and transesterified oils of mixtures of one or more of the aforementioned oils. The milk component content in the milk-containing beverage of this invention is not particularly limited, but is preferably in the range of 0.1 to 10 mass% in terms of solids content, at the time of drinking. As referred to above, the “solids” refers to a solid dried product obtained after drying milk-derived components using a common drying method (*e.g.*, freeze-drying, evaporation to dryness) to remove moisture.

[0043] In one embodiment, the packaged beverage of the present invention is characterized in that the lower limit of the lipid content in the beverage, in accordance with the nutrition labeling standards as stipulated under the nutrition improvement act in Japan, is preferably 0.4 g, more preferably 0.45 g, still more preferably 0.5 g, per 100 g of beverage, and the upper limit of said lipid content is preferably 1.0 g, more preferably 0.9 g, still more preferably 0.8 g, per 100 g of beverage.

[0044] (Other components)

Like common beverages, the packaged beverage of the present invention may have any of various additives and other components added thereto alone or in combination, to the extent that such additives do not interfere with the effects of this invention. Examples of such additives include, but are not limited to, acidulants, flavorants, vitamins, pigments, antioxidants, emulsifiers, preservatives, seasonings, essences, pH adjustors, thickeners, and quality stabilizers.

[0045] The beverage of the present invention may contain a sugar including glucose. The beverage of this invention can contain one or two or more of natural and/or artificial sweeteners. In a preferred embodiment, the beverage of this invention contains fructose-glucose syrup.

[0046] A pH adjustor is a component that is capable of reducing a decline in pH during sterilization and which produces an alkaline pH when dissolved in water. Specific examples

of a pH adjustor include, but are not limited to, baking soda (sodium bicarbonate), potassium carbonate, potassium hydroxide, trisodium phosphate, and tripotassium phosphate. When baking soda is used as a pH adjustor, the amount of baking soda added is not more than 0.1 wt.%, preferably not more than 0.05 wt.%, based on the total weight of the beverage.

[0047] A sweetening component refers to a component that imparts sweetness. Examples of a sweetening component include, but are not limited to, sucrose, isomerized sugar, glucose, fructose, lactose, maltose, xylose, isomerized lactose, fructo-oligosaccharide, malto-oligosaccharide, isomalto-oligosaccharide, galacto-oligosaccharide, coupling sugar, palatinose, maltitol, sorbitol, erythritol, xylitol, lactitol, Palatinat, saccharified reduced starch, stevia, glycyrrhizin, thaumatin, monellin, aspartame, alitame, saccharin, acesulfame K, sucralose, and dulcin.

[0048] In a preferred embodiment, the packaged beverage of the present invention, at the time of drinking, has a Brix value, including alcohol, of 1 to 6, more preferably 2 to 5, still more preferably 2 to 4. In the inventive beverage, the upper limit of Brix, including alcohol, may be 7, and the lower limit of Brix may be 1. The concentration of soluble solids can be evaluated by means of Brix values determined using a sugar content meter, refractometer, etc. The Brix is a value obtained by converting a refractive index measured at 20°C into a mass/mass percentage of sucrose in solution based on the conversion table published by ICUMSA (the International Commission for Uniform Methods of Sugar Analysis). The Brix is expressed in unit of “°Bx”, “%” or “degree”.

[0049] The beverage of the present invention may also be a low-solute beverage with a low concentration of soluble solids in solution -- *i.e.*, a so-called low-calorie beverage labeled as “sugar-free”, “saccharide-free”, “low-calorie” or the like. The labelings as “sugar-free”, “saccharide-free”, “low-calorie” or the like are defined in the nutrition labeling standards as stipulated under the health promotion act in Japan. For example, the label as “sugar-free” is placed on beverages whose content of a sugar (which is a monosaccharide or disaccharide, and is not a sugar alcohol) is less than 0.5 g per 100 g of beverage. The label as “saccharide-free” is placed on beverages with a saccharide concentration of less than 0.5

g/100 mL. The “saccharide” is a type of carbohydrate which is one of the three major nutrients, and is a generic name for available carbohydrates calculated by subtracting dietary fiber content from total carbohydrates.

[0050] In a preferred embodiment, the pH of the beverage of the present invention can be adjusted to acidic pH, from the viewpoints of long-term storage and protection against microbial contamination. To be specific, the pH of the inventive beverage is preferably adjusted to be in the range of 1.5 to 5.0, more preferably 1.8 to 4.5, still more preferably 2.1 to 4.0, or may be adjusted to be in the range of 2.4 to 3.5.

EXAMPLES

[0051] Hereunder, the present invention will be described in more detail by way of specific test examples, but this invention is not limited to the test examples given below. Unless otherwise stated herein, all concentrations and other like parameters are expressed on a mass basis, and all numerical ranges are inclusive of their endpoints.

[0052] Test Example 1: Preparation and evaluation of packaged beverages (coffee beverages)

(1) Preparation of packaged beverages

[Instant Example]

Coffee beans were used as an ingredient to prepare a coffee essence with a solids concentration of about 45% (a liquid coffee concentrate composed of coffee components extracted from roasted coffee beans with hot water under pressure). The coffee essence was diluted with ion exchange water, and the dilution was adjusted with baking soda (sodium bicarbonate) to a pH of about 6.0 and a solids concentration of 20 wt.%. The adjusted solution was used as solution A.

[0053] A slurry in which ground roasted coffee beans were expanded in water was continuously distilled at 100°C by bringing it into countercurrent contact with steam using a spinning cone column (SCC), to prepare a steam distillate of coffee. Steam distillation is a technique in which steam is blown into an organic compound having a high boiling point and practically insoluble in water (*i.e.*, coffee in this example) to distill out the compound with

steam. The steam distillate of coffee is a liquid distillate obtained by distilling coffee beans with steam. The obtained steam distillate of coffee was diluted with ion exchange water, and the dilution was adjusted to a solids concentration of 0.02 wt.% and a pH of about 5.5. The adjusted solution was used as solution B.

[0054] Next, solutions A and B were each packed in separate beverage storage segments and retort sterilized (at 123°C for 10 min.) to prepare a concentrated-type packaged coffee beverage. After the prepared packaged beverage was stored at ordinary temperature (23°C) for 20 days, solutions A and B were mixed in equal amounts, and the mixture was diluted with ion exchange water to a solids concentration of 1% to prepare a coffee beverage.

[0055] [Comparative Example]

The same coffee essence and steam distillate of coffee as used in Instant Example were mixed at the same ratio as in Instant Example. The mixture was diluted with ion exchange water, and the dilution was adjusted with baking soda to a pH of about 6.0 and a solids concentration of 10 wt.%. Then, the solution was packed in one package and retort sterilized (at 123°C for 10 min.) to prepare a concentrated-type packaged coffee beverage. After the prepared packaged beverage was stored at ordinary temperature (23°C) for 20 days, the package was opened and the content was diluted with ion exchange water to a solids concentration of 1% to prepare a coffee beverage.

[0056] (2) Analysis of sulfur-containing aroma components

Analysis of sulfur-containing aroma components was performed on a gas chromatographic system (GC-2010 Plus, produced by Shimadzu Corporation) equipped with a detector (FPD, produced by Shimadzu Corporation), an autosampler (AOC-6000, produced by Shimadzu Corporation), a column (InertCap Pure-WAX, 0.18 mm × 20 m, film thickness 0.18 μm, produced by GL Sciences), and a SPME fiber (50/30 μm DVB/CAR/PDMS, Stable flex 2 cm). With the inlet temperature set to 250°C, the column flow rate set to 1 mL/min, the detector temperature set to 260°C, the hydrogen flow rate set to 40 mL/min, and the air flow rate set to 60 mL/min, the measurement was performed by holding the temperature at 40°C for 5 minutes, followed by increasing the temperature to 250°C at a rate of 12°C/min.

and then holding it at 250°C for 7.5 minutes. The samples to be analyzed were preheated (at 60°C for 5 min.) and then extracted by adsorption (at 60°C for 20 min.) and desorption (at 250°C for 2 min.). Sulfur-containing aroma components were evaluated by peak area.

[0057] (3) Quantification of total polyphenols concentration

Determination of total polyphenols concentration was carried out. To be specific, 8.3 mL of water was metered into a test tube, and to the test tube 0.2 mL of each sample to be determined was added and homogenized. Separately, gallic acid monohydrate was dissolved in water to prepare 0 mg/L, 100 mg/L, 300 mg/L and 500 mg/L of aqueous gallic acid solutions, which were used as standard solutions. For each of the samples and standard solutions, a phenol reagent (produced by Wako Pure Chemical Industries, 279-08895) was added, followed by addition of 1 mL of a 10% solution of anhydrous sodium carbonate within 5 minutes. Immediately afterwards, the solution was stirred, homogenized and reacted at 30°C for 30 minutes. After the reaction, the reaction mixture was transferred to a cell and measured for absorbance (absorbance at 760 nm) in a spectrophotometer (produced by Shimadzu Corporation, UV-1600). Calibration curves were constructed based on the results for the standard solutions, and on that basis, total polyphenols concentrations were quantified.

[0058] (4) Evaluation of packaged beverages

The beverages of Instant and Comparative Examples were subjected to sensory evaluation for aroma by five trained panelists. The intensity of coffee-like roast aroma was rated on a six-grade scale, and the ratings of the individual panelists were averaged. The evaluation criteria are as follows. A higher rating means a higher intensity of “coffee-like roast aroma”.

- 5 points: Coffee-like roast aroma was strongly felt
- 4 points: Coffee-like roast aroma was fully felt
- 3 points: Coffee-like roast aroma was felt
- 2 points: Coffee-like roast aroma was somewhat felt
- 1 point: Coffee-like roast aroma was hardly felt at all

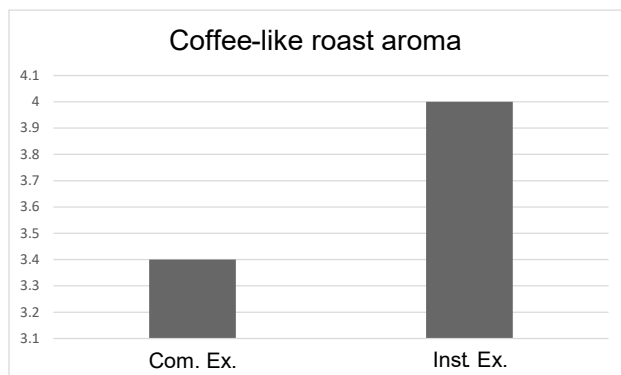
- 0 point: No coffee-like roast aroma was felt

[0059] (5) Analysis results and aroma evaluation results

As a result of the sensory evaluation on “coffee-like roast aroma”, it was confirmed that the beverage of Instant Example was rated 4.0 points (standard deviation: 0.09) whereas that of Comparative Example was rated 3.4 points (standard deviation: 0.22), and thus that the present invention can significantly enhance the “roast aroma of a coffee beverage”. It was also confirmed that the coffee beverage of Instant Example contained sulfur-containing aroma components in an amount that was at least 20% greater than that of Comparative Example, and was rich in aroma components involved in coffee-like roast aroma (peak area: 7927460 for Instant Example vs. 6546445 for Comparative Example).

[0060] Further, total polyphenols concentration was determined to be 25165 ppm (standard deviation: 353) for Instant Example (solution A), 11 ppm for Instant Example (solution B), and 12534 ppm (standard deviation: 179) for Comparative Example.

[0061] [Table 1]



	Comparative Example	Instant Example (solution A)	Instant Example (solution B)
Total polyphenols concentration (ppm)	12534	25165	11

[0062] (6) Analysis of sulfur-containing aroma components (before dilution)

By the same procedure as described in (1), a coffee essence (solution A) and a steam distillate of coffee (solution B) were prepared and each packed and stored in separate beverage storage segments (Instant Example). Also, by the same procedure as in (1), a concentrated-type packaged beverage was prepared and stored (Comparative Example).

[0063] Further, by the same procedure as described in (2), the liquid concentrates before dilution were analyzed for sulfur-containing aroma components. The results are shown in the table given below. As evident from the table below, it was confirmed that in the case where the coffee essence (solution A) and the steam distillate of coffee (solution B) were each packed and stored in separate beverage storage segments (Instant Example), the steam distillate of coffee (solution B) after storage remained to contain sulfur-containing aroma components in larger amounts as compared to the mixture of the coffee essence (solution A) and the steam distillate of coffee (solution B) after storage (Comparative Example), and thus that according to the present invention, a packaged coffee beverage can retain its coffee-like roast aroma for a long time.

[0064] [Table 2]

	Comparative Example	Instant Example (solution A)	Instant Example (solution B)
Sulfur-containing aroma components (peak area)	1423444	539274	24385434

[0065] Test Example 2: Preparation and evaluation of packaged beverages (tea beverages)

(1) Preparation of packaged beverages

[Instant Example]

A green tea powder (a powder produced by spray drying a green tea extract), baking soda (sodium bicarbonate), and sodium ascorbate were dissolved in ion exchange water so as to adjust the solids concentration to 6 wt.%. The adjusted solution was used as solution A.

[0066] A steam distillate of green tea was dissolved in ion exchange water so as to adjust the solids concentration to almost zero. The adjusted solution was used as solution B. The steam distillate of green tea was produced by performing continuous distillation at 100°C by bringing a green tea solution into countercurrent contact with steam using a spinning cone column (SCC).

[0067] Next, solutions A and B were each packed in separate beverage storage segments and retort sterilized (at 123°C for 10 min.) to prepare a concentrated-type packaged tea

beverage. After the prepared packaged beverage was stored at ordinary temperature (23°C) for 20 days, solutions A and B were mixed in equal amounts, and the mixture was diluted with ion exchange water to a solids concentration of 0.3% to prepare a tea beverage.

[0068] [Comparative Example]

The same green tea powder and steam distillate of green tea as used in Instant Example, baking soda (sodium bicarbonate) and sodium ascorbate were dissolved in ion exchange water so as to adjust the solids concentration to 3 wt.% (the mixing ratio of the green tea powder and the steam distillate of green tea in Comparative Example was the same as that in Instant Example). Then, the solution was packed in one package and retort sterilized (at 123°C for 10 min.) to prepare a concentrated-type packaged tea beverage. After the prepared packaged beverage was stored at ordinary temperature (23°C) for 20 days, the package was opened and the content was diluted with ion exchange water to a solids concentration of 0.3% to prepare a tee beverage.

[0069] (2) Measurement of nonanal concentration

For the purpose of determining the concentration (ppb) of nonanal present in each of the beverages (sample solutions) of Instant Example and Comparative Example before dilution with ion exchange water, each sample was placed in a 10 mL vial (with a volume of 20 mL), 3 g of NaCl was added, and the mixture was quantified for nonanal content using a GC-MS system (produced by Agilent Technologies) by a multi-volatile method (MVM) under the conditions detailed below.

- System:

GC: GC7890B, produced by Agilent Technologies

MS: 5977A, produced by Agilent Technologies

HS: MPS, produced by Gestel

Tube: Tenax TA, Carbon bx1000

- Column: HP-INNOWAX, 60 m × 0.25 mm i.d., df = 0.25 µm

- Quantitative ion: Hexanal, 56.0 m/z

- Temperature conditions: 40°C (4 min.) => 5°C/min. => 260°C

- Carrier gas flow rate: He, 1.5 mL/min.

- Injection method: Splitless

- Ion source temperature: 260°C

[0070] (3) Amino acids content

Solutions A and B as prepared in Instant Example, and the beverage of Comparative Example were each quantified for amino acids concentration by HPLC under the conditions detailed below. To be specific, the following eight amino acids: aspartic acid, glutamic acid, serine, glycine, threonine, alanine, proline, and theanine, were quantified using a standard reference, and the total amount of these amino acids was calculated.

- HPLC system: Waters amino acid analyzer 2695

- Column: AccQ-Tag column (3.9 mm × 150 mm)

- Column temperature: 40°C

- Mobile phase A: AccQ-TagA (pH 5.8)

- Mobile phase B: Acetonitrile

- Mobile phase C: Water/methanol = 9/1

- Detection: EX 250 nm, EM 395 nm, Gain 100

- Injection volume: 5 µL

- Gradient program:

Time (min.)	Flow rate (mL/min)	%A	%B	%C
0	1	100	0	0
1	1	99	1	0
16	1	97	3	0
25	1	94	6	0
35	1	86	14	0
40	1	86	14	0
50	1	82	18	0
51	1	0	60	40
54	1	100	0	0

75	1	0	60	40
110	0	0	60	40

[0071] (4) Evaluation of packaged beverages

The beverages of Instant and Comparative Examples were subjected to sensory evaluation for aroma by five trained panelists. The intensity of “gourd-like aroma” (characteristic aroma of *Gyokuro*) which characterizes fresh tea aroma was rated on a six-grade scale, and the ratings of the individual panelists were averaged. The evaluation criteria are as follows. A higher rating means a higher intensity of “gourd-like aroma”.

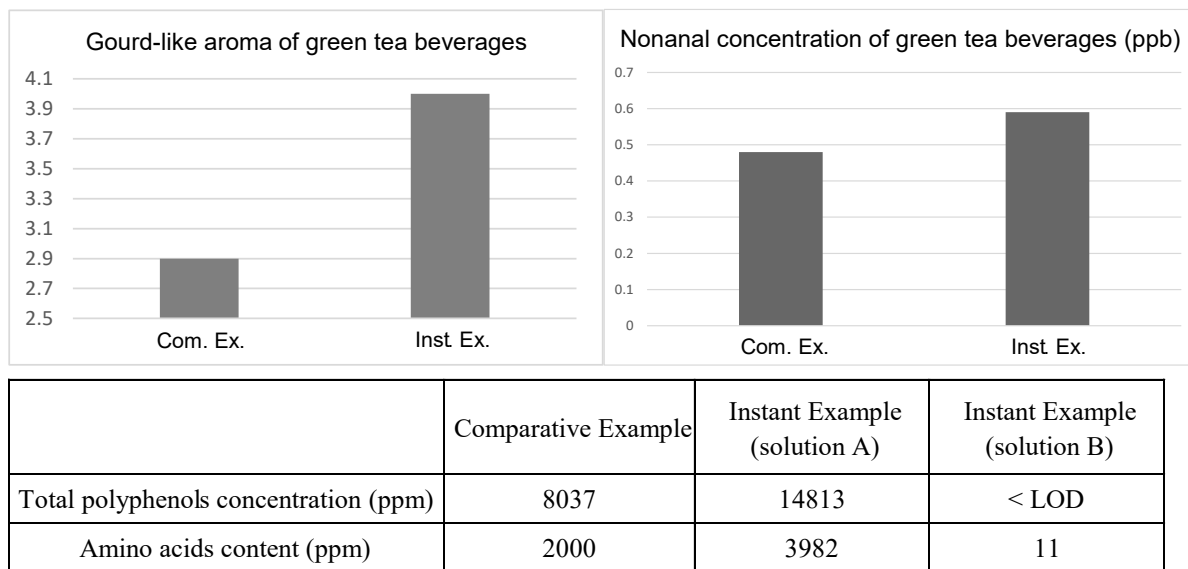
- 5 points: Gourd-like aroma was strongly felt
- 4 points: Gourd-like aroma was fully felt
- 3 points: Gourd-like aroma was felt
- 2 points: Gourd-like aroma was somewhat felt
- 1 point: Gourd-like aroma was hardly felt at all
- 0 point: No gourd-like aroma was felt

[0072] (5) Analysis results and aroma evaluation results

As a result of the sensory evaluation on the gourd-like aroma of the green tea beverages, it was confirmed that the beverage of Instant Example was rated 4.0 points (standard deviation: 0.7) whereas that of Comparative Example was rated 2.9 points (standard deviation: 0.8), and thus that the present invention can significantly enhance the gourd-like aroma of a green tea beverage. It was also confirmed that the beverage of Instant Example contained nonanal in an amount that was at least 20% greater than that of Comparative Example, and was rich in an aroma component involved in gourd-like aroma (nonanal concentration: 0.59 ppb for Instant Example vs. 0.48 ppb for Comparative Example).

[0073] The results of the analysis of nonanal concentration, total polyphenols concentration, and amino acids concentration are shown in the table given below.

[0074] [Table 3]



[0075] (6) Measurement of nonanal concentration (before dilution)

By the same procedure as described in (1), a green tea powder solution (solution A) and a steam distillate of green tea (solution B) were prepared and each packed and stored in separate beverage storage segments (Instant Example). Also, by the same procedure as in (1), a concentrated-type packaged beverage was prepared and stored (Comparative Example).

[0076] Further, by the same procedure as described in (2), the liquid concentrates before dilution were analyzed for nonanal concentration. The results are shown in the table given below. As evident from the table below, it was confirmed that in the case where the green tea powder solution (solution A) and the steam distillate of green tea (solution B) were each packed and stored in separate beverage storage segments (Instant Example), the steam distillate of green tea (solution B) after storage retained a higher nonanal concentration as compared to the mixture of the green tea powder solution (solution A) and the steam distillate of green tea (solution B) after storage (Comparative Example), and thus that according to the present invention, a packaged tea beverage can retain an aroma component involved in gourd-like aroma for a long time.

[0077] [Table 4]

	Comparative Example	Instant Example (solution A)	Instant Example (solution B)
Nonanal concentration (standard deviation)	3.7 ppb (0.13)	2.5 ppb (0.32)	6.7 ppb (0.08)

CLAIMS

1. A packaged coffee beverage or packaged tea beverage comprising two or more beverage compositions that differ in the compositional profile of components and are each packed separately in two or more beverage storage segments, wherein the total polyphenols concentration in one beverage composition packed in one beverage storage segment is higher than that in a different beverage composition packed in a different beverage storage segment.
2. The beverage according to claim 1, wherein the beverage is a concentrated-type beverage that is drunk after the two or more beverage compositions packed in the beverage storage segments are diluted.
3. The beverage according to claim 1 or 2, wherein the beverage is drunk after the two or more beverage compositions packed in the beverage storage segments are mixed together.
4. The beverage according to any of claims 1 to 3, wherein the package is a package having two beverage storage segments.
5. The beverage according to any of claims 1 to 4, wherein the beverage is a packaged coffee beverage in which the concentration of a sulfur-containing aroma component in one beverage composition packed in one beverage storage segment is lower than that in a different beverage composition packed in a different beverage storage segment.
6. The beverage according to any of claims 1 to 5, wherein the beverage is a packaged coffee beverage in which the concentration of a sulfur-containing aroma component in a composition into which the beverage compositions packed in the two or more beverage storage segments are mixed together after they are each separately sterilized is higher than that in a composition that is sterilized after the beverage compositions are mixed together.

7. The beverage according to any of claims 1 to 4, wherein the beverage is a packaged tea beverage in which the nonanal concentration in one beverage composition packed in one beverage storage segment is lower than that in a different beverage composition packed in a different beverage storage segment.

8. The beverage according to any of claims 1 to 4 and 7, wherein the beverage is a packaged tea beverage in which the nonanal concentration in a composition into which the beverage compositions packed in the two or more beverage storage segments are mixed together after they are each separately sterilized is higher than that in a composition that is sterilized after the beverage compositions are mixed together.

9. A method for producing the beverage according to any of claims 1 to 8, the method comprising a step of packing two or more beverage compositions that differ in compositional profile separately in two or more beverage storage segments.