

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 the off-flavor peculiar to a beverage with high fruit juice content can be prevented from developing or can be masked by sterilizing a liquid preparation under the condition of addition of a particular amount of phosphoric acid. 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, speaking of the deterioration of an aroma component of a beverage over time, it has been reported that citrus aroma components denature at low pH (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 2011-167170

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: *Off-Flavors in Food and Beverages*, 1992, pages 229-285

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 confirmed that when a beverage composition with a pH of 3.5 or more and a beverage composition with a pH of less than 3.5 are spatially separated from each other, and one beverage composition packed in one storage segment is controlled to pH 3.5 or more, aroma components become less likely to decrease, so that the deterioration in the aroma of a beverage 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 fruit juice beverage packed in a package, 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 at least one of the beverage

compositions has a pH of 3.5 or more.

(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 concentration of citral in a beverage composition packed in one beverage storage segment is higher 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 composition with a high citral concentration has a pH of 3.5 or more.

(7) The beverage as set forth in any of (1) to (6), wherein the concentration of citral 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.

(8) The beverage as set forth in any of (1) to (7), wherein at least one of the beverage compositions contains an alcohol.

(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.

BRIEF DESCRIPTION OF DRAWING

[0012] [FIG. 1] FIG. 1 shows a graph of the results of the experiment in Test Example 1 (x-axis: pH, y-axis: citral concentration).

DESCRIPTION OF EMBODIMENTS

[0013] 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 a beverage composition packed in one beverage storage segment has a pH of 3.5 or more.

[0014] 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.

[0015] 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 fruit juice beverage is diluted using an alcohol as a diluting liquid, the beverage can be drunk as a shochu-based beverage or the like. 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.

[0016] 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.

[0017] 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.

[0018] 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.

[0019] 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.

[0020] 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; 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.

[0021] In general, components that impart a characteristic aroma to a beverage have a tendency to deteriorate easily over time due to various influences such as heat. Further, under such conditions that can promote deterioration, such components may be more liable to deterioration. Thus, in the present invention, two or more beverage compositions that differ in composition profile are each packed separately in two or more beverage storage segments, and at least one of the beverage compositions is controlled to pH 3.5 or more, so that the two or more 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.

[0022] In the packaged beverage of the present invention, components that lower pH, such as organic acids, 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), whereby a significant reduction of deterioration can be expected. Examples of aroma components include not only components that mainly affect aroma, but also components that mainly affect the sense of 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, at least one beverage composition packed in at least one beverage storage segment is controlled to pH 3.5 or more, but may be controlled to pH 4.0 or more, or to pH 4.5 or more. The upper limit of pH is not particularly limited, and can be, for example, not more than pH 10.0 or may be not more than pH 9.0 or not more than pH 8.0.

[0024] Further, in the present invention, components that characterize a fresh aroma of a

fruit juice can be incorporated in a beverage composition with a pH of 3.5 or more.

Examples of such aroma components include, but are not limited to, citral, terpineol, octanal, citronellal, α -pinene, β -pinene, γ -terpinene, myrcene, terpinen-4-ol, and nerol.

[0025] Fruit juice-containing beverage

In a preferred embodiment of the present invention, the packaged beverage of this invention can be a fruit juice-containing beverage. In this embodiment, a beverage composition packed in at least one beverage storage segment is to contain a fruit juice.

[0026] With regard to components that characterize a fresh aroma of a fruit juice, the “freshness of lemon”, for example, is imparted by such components as citral, terpineol, octanal, citronellal, α -pinene, β -pinene, γ -terpinene, myrcene, terpinen-4-ol, and nerol. Such components tend to be more liable to deterioration at low pH values.

[0027] In the present invention, the “fruit juice” is used as a concept that includes not only juices squeezed from fruits but also those squeezed from vegetables. The type of a fruit used as an ingredient to make a fruit juice is not particularly limited, and any types of fruits commonly used in the art can be used. Specific examples of fruits include, but are not limited to, citrus fruits (*e.g.*, orange, satsuma tangerine, *Citrus unshiu*, navel orange, *Citrus reticulata* var. *poonensis*, *Citrus natsudaoidai*, lemon, grapefruit, lime, *Citrus hassaku*, *Citrus iyo*, *Citrus junos*, *Myrciaria dubia*, *Citrus depressa*, *Citrus sphaerocarpa*, mandarin orange, tangerine orange, temple tangor, tangelo, calamondin), strawberry, raspberry, blueberry, blackberry, black currant, cherry, apple, grape, pomegranate, kiwi fruit, muscat, peach, pineapple, guava, banana, passion fruit, mango, acerola, prune, papaya, passion fruit, *Prunus mume*, Japanese pear (*Pyrus pyrifolia* var. *culta*), apricot, lychee, melon, watermelon, European pear (*Pyrus communis*), persimmon, loquat, fig, and *Prunus salicina*. Preferred examples of a fruit used as an ingredient to make a fruit juice are citrus fruits. For making a fruit juice, any one type of the aforementioned fruits may be used alone, or two or more types thereof may be used in combination. When two or more types of fruits are used in combination, the ratio of different fruits (fruit juices) can be adjusted as appropriate depending on the need and is not particularly limited.

[0028] The type of a vegetable used as an ingredient for squeezing a vegetable juice is not particularly limited, and any types of vegetables commonly used in the art can be used. Specific examples of a vegetable include, but are not limited to, carrot, onion, broccoli, turnip radish, cabbage, brussels sprouts, brussels sprout leaf, celery, spinach, green pepper, asparagus, young barley leaf, crown daisy, napa cabbage, Chinese mustard leaf, butterheaded lettuce, Japanese mustard spinach, *Brassica rapa* var. *chinensis*, *Angelica keiskei*, Spanish potato, potato, tomato, Jew's mallow, bell pepper, watercress, parsley, celery, Japanese honeywort, iceberg lettuce, radish, kale, brussels sprout leaf, perilla, eggplant, radish, kidney bean, pumpkin, burdock, Welsh onion, ginger, garlic, Chinese chives, *Brassica juncea* var. *integrifolia*, cauliflower, corn, podded pea, okra, turnip, cucumber, German turnip, gourd, summer squash, loofah, bean sprout, and sprouts of different cultivars. For making a vegetable juice, any one type of the aforementioned vegetables may be used alone, or two or more types thereof may be used in combination. When two or more types of vegetables are used in combination, the ratio of different vegetables (vegetable juices) can be adjusted as appropriate depending on the need and is not particularly limited.

[0029] A fruit juice can be obtained by squeezing a fruit or vegetable used as an ingredient by following a technique known in the art. Examples of such a known technique include, but are not limited to: squeezing performed by compressing a vegetable as an ingredient, which has been optionally pretreated by washing, sterilization, peeling, removal of skins, seeds, etc., blanching, crushing, pureeing and/o the like, using a hydraulic pressing machine, a roller pressing machine, or an inline squeezer; squeezing performed by crushing using a pulper/finisher, etc.; and squeezing performed by crushing using a crusher, etc. followed by extraction using an extractor, etc. Further, a juice squeezed by such a technique may be, as desired, treated with an enzyme such as pectinase or cellulase, processed in a juicer, and/or sterilized. If necessary, a fruit juice may be concentrated -- in such a case, concentration is performed by a known method such as common heat concentration, low-pressure concentration, low-temperature concentration, vacuum concentration, freeze concentration, or reverse osmosis concentration.

[0030] The form of a fruit juice is not particularly limited, and the fruit juice can be in any form, such as liquid, gel, paste (quasi-solid), semi-solid, or solid. If necessary, the fruit juice may further contain some other components (*e.g.*, small amounts of salt, spice, food additives, etc.).

[0031] Preparation of a fruit juice can be omitted by obtaining a commercially available product. There are commercially available fruit juice products, such as straight fruit/vegetable juice, mixed fruit/vegetable juice, fruit/vegetable paste, fruit/vegetable puree, and concentrated fruit/vegetable puree. As referred to above, the “straight fruit/vegetable juice” refers to a fruit/vegetable juice simply squeezed from a single type of fruit or vegetable. The “mixed fruit/vegetable juice” refers to a fruit/vegetable juice squeezed from two or more types of fruits and/or vegetables.

[0032] In this connection, the “straight juice” refers to a straight juice as stipulated in the JAS standards -- *i.e.*, a fruit juice simply squeezed from a fruit, or a fruit juice with only addition of components authorized in the JAS standards. The “straight fruit juice” and “from-concentrate fruit juice” refer respectively to a fruit juice obtained by adding components authorized in the JAS standards, in specified proportions and as necessary, to a fruit juice simply squeezed from a fruit, and to a product obtained by concentrating such a straight fruit juice to a specified level. Examples of components authorized in the JAS standards include, but are not limited to, antioxidants such as vitamin C (including L-ascorbic acid and sodium L-ascorbate), table sugar, honey, and natural flavorants. Examples of other additives that can be added to a fruit juice but fall outside the JAS standards include, but are not limited to, acidulants and pH adjustors such as citric acid and sodium citrate, enzymes, stabilizers such as pectin, other sugars than table sugar, and synthetic flavorants.

[0033] With regard to components that characterize a fresh aroma of a fruit juice, such components as citral, terpineol, octanal, citronellal, α -pinene, β -pinene, γ -terpinene, myrcene, terpinen-4-ol, and nerol are characteristically present in lemon, but tend to be more liable to deterioration at low pH values. Therefore, it is preferred that such components should be biasedly distributed in a beverage composition with a pH of 3.5 or more.

[0034] (Alcoholic beverage)

In one embodiment, the packaged beverage of the present invention is an alcoholic beverage containing an alcohol. As referred to in this invention, the “alcoholic beverage” refers to a beverage in which an alcohol is present at the time of drinking. The “alcohol” as referred to herein means ethyl alcohol (ethanol), unless otherwise specified.

[0035] The type of the alcoholic beverage of the present invention is not particularly limited as long as it contains an alcohol. As an alcohol material, a distilled liquor or a brewed alcoholic beverage can be used. Specific examples of an alcohol material include, but are not limited to, spirits (*e.g.*, rum, vodka, gin), liqueurs, whiskey, brandy, and shochu. Brewed alcoholic beverages such as beer may also be used. Such alcohol materials may each be used alone or may be used in combination.

[0036] The alcohol concentration of the packaged beverage of the present invention at the time of drinking is not particularly limited, but is preferably not more than 22 v/v%, more preferably not more than 18 v/v%, still more preferably not more than 14 v/v%. The lower limit of the alcohol concentration is not particularly limited, but is preferably not less than 1 v/v%, more preferably not less than 3 v/v%, still more preferably not less than 5 v/v%, or may be not less than 7 v/v%. In a particularly preferred embodiment, the packaged beverage of this invention has an alcohol concentration of 3 to 14 v/v% at the time of drinking.

[0037] (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.

[0038] (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.

[0039] In general, milk-containing beverages are preferred to contain both milk fat and a solid-non-fat component. 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.

[0040] 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.

[0041] (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.

[0042] 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.

[0043] 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.

[0044] 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.

[0045] In a preferred embodiment, the packaged beverage of the present invention, at the time of drinking, has a Brix value, including alcohol, of 10 to 25, more preferably 11 to 20, still more preferably 12 to 18. In the inventive beverage, the upper limit of Brix, including alcohol, may be 31, and the lower limit of Brix may be 7. 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”.

[0046] 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.

[0047] 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

[0048] 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.

[0049] Test Example 1: Effects of pH during heating on the stability of an aroma component

This example investigated the effects of pH on the stability of an aroma component. To be specific, an experiment was conducted on an aqueous solution containing 1 ppm of citral to determine the relationship between pH during heating and a citral concentration after heating.

[0050] (1) Heating experiment

Test solutions were prepared by incorporating 1 ppm of citral in each of different citrate buffers with varied pHs (citric acid/sodium citrate). The prepared test solutions were heated in an aluminum heat block at 100°C for one hour. After heating, the test solutions were stored on ice.

[0051] (2) Quantification of an aroma component

The concentration of citral was quantified using HPLC. The concentrations of neral and geranial were each quantified under the conditions detailed below, and the total of these concentrations was regarded as a citral concentration. Calibration curves were constructed for neral and geranial using a 100 ppb standard product, and quantification was performed based on the calibration curves.

- HPLC: LC-10ADVP series (produced by Shimadzu Corporation)
- Column: Imtakt Cadenza CD-C18 (3 μ m, 150 mm $\times$ 4.6 mm)
- Column oven temperature: 40°C
- Flow rate: 1 mL/min

- Initial solvent concentration: 40%
- Detection wavelength: 240 nm
- Mobile phase (solution A: 0.1% phosphoric acid aqueous solution; solution B: 0.1% phosphoric acid-containing acetonitrile)
- Mobile phase gradient conditions (% by volume):

Time	Solution A	Solution B
0 min.	95%	5%
5 min.	95%	5%
10 min.	60%	40%
30 min.	40%	60%
30.5 min.	5%	95%
35.5 min.	5%	95%
36.5 min.	95%	5%
42 min.	95%	5%

[0052] (3) Test results

The results of citral concentration determination by HPLC (LC-10ADVP series, produced by Shimadzu Corporation) are shown in the table given below. As evident from the table, it was confirmed that when the pH was lower than 3, the citral concentration significantly declined after heating.

[0053] [Table 1]

pH of citral solution	5.94	5.47	5.08	4.71	4.33	3.95	3.53	3.09	2.64	2.00
Citral concentration (after 60 min. heating, ppm)	0.12	0.12	0.12	0.11	0.1	0.11	0.1	0.09	0.06	0.01

[0054] Test Example 2: Preparation and evaluation of packaged beverages (fruit juice carbonated beverages)

(1) Preparation of packaged beverages

[Instant Example]

A citrus flavorant (containing citral) was dissolved in ion exchange water so as to adjust the solids concentration to 1.2 wt.% and the pH to about 3.6 (solution A). Separately,

a frozen concentrated clear lemon juice (7-fold concentrate), citric acid (anhydrous), aspartame, acesulfame potassium, sucralose, trisodium citrate, and L-ascorbic acid were dissolved in ion exchange water to adjust the solids concentration to 15.1 wt.% and the pH to about 3.1 (solution B). The citral concentration was higher in solution A than in solution B.

[0055] Next, solutions A and B were each packed in separate beverage storage segments and sterilized by immersion in heated water (at 75°C for 10 min.) to prepare a concentrated-type packaged 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 carbonated water (“Minami-Alps Tennensui Sparkling”, produced by Suntory Beverage & Food Limited) to give a solids concentration of 0.85%.

[0056] [Comparative Example]

A frozen concentrated clear lemon juice (7-fold concentrate), citric acid (anhydrous), aspartame, acesulfame potassium, sucralose, trisodium citrate, L-ascorbic acid, and a citrus flavorant (containing citral) were dissolved in ion exchange water so as to adjust the solids concentration to 8.5 wt.% and the pH to about 3.2 (the mixing ratio of lemon juice and a citrus flavorant in Comparative Example was the same as that in Instant Example). Then, the solution was packed in one package and sterilized by immersion in heated water (at 75°C for 10 min.) to prepare a concentrated-type packaged beverage. After the prepared packaged beverage was stored at ordinary temperature (23°C) for 20 days, the beverage was diluted with carbonated water to give a solids concentration of 0.85%.

[0057] (2) 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 freshness of lemon 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 “freshness of lemon”.

- 5 points: The freshness of lemon was strongly felt

- 4 points: The freshness of lemon was fully felt

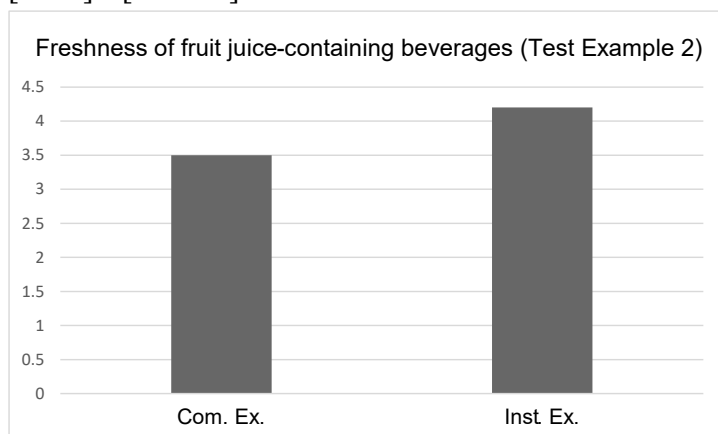
- 3 points: The freshness of lemon was felt
- 2 points: The freshness of lemon was somewhat felt
- 1 point: The freshness of lemon was hardly felt at all
- 0 point: No freshness of lemon was felt

[0058] (3) Analysis results and aroma evaluation results

As a result of the evaluation on the “freshness of lemon” of the fruit juice carbonated beverages, it was confirmed that the beverage of Instant Example was rated 4.2 points (standard deviation: 0.45) whereas that of Comparative Example was rated 3.5 points (standard deviation: 0.61), and thus that the present invention can significantly enhance the “freshness of lemon” of a fruit juice carbonated beverage.

[0059] Further, as a result of the quantification of the citral concentration (total of neral and geranial concentrations) in the beverages of Instant and Comparative Examples by the same procedure as in Test Example 1, it was confirmed that the beverage of Instant Example had a citral concentration of 69 ppm (standard deviation: 0.12) whereas that of Comparative Example had a citral concentration of 7 ppm (standard deviation: 0.03) -- the citral concentration was about 10 times higher in Instant Example than in Comparative Example -- and thus that the present invention can significantly increase the citral content of a fruit juice carbonated beverage.

[0060] [Table 2]



	Comparative Example	Instant Example
Citral (ppm)	7	69
Sensory rating	3.5	4.2

[0061] Test Example 3: Preparation and evaluation of packaged beverages (alcoholic beverages)

(1) Preparation of packaged beverages

[Instant Example]

A lemon-soaked liquor, a neutral spirit (alcohol concentration: 59 v/v%), and a citrus flavorant (containing citral) were dissolved in ion exchange water so as to adjust the alcohol concentration to 36 wt.% and the pH to about 4.6 (solution A). Separately, a from-concentrate lemon juice (7-fold concentrate), citric acid (anhydrous), aspartame, acesulfame potassium, sucralose, trisodium citrate, and L-ascorbic acid were dissolved in ion exchange water so as to adjust the pH to about 2.7 (solution B). The citral concentration was higher in solution A than in solution B.

[0062] Next, solutions A and B were each packed in separate beverage storage segments and sterilized by immersion in heated water (at 60°C for 10 min.) to prepare a concentrated-type packaged beverage. Then, after the prepared packaged beverage was stored under each of the conditions detailed below, solutions A and B were mixed in equal amounts, and the mixture was diluted with carbonated water (“Minami-Alps Tennensui Sparkling”, produced by Suntory Beverage & Food Limited) to give an alcohol concentration of 9%, whereby a

fruit juice-containing alcoholic beverage (shochu-based beverage) was prepared.

- Condition 1: Stored at ordinary temperature (23°C) for 20 days
- Condition 2: Stored at 50°C for 6 days (accelerated test equivalent to storage at 23°C for 180 days)

[0063] [Comparative Example]

A lemon-soaked liquor, a neutral spirit (alcohol concentration: 59 v/v%), a from-concentrate lemon juice (7-fold concentrate), citric acid (anhydrous), aspartame, acesulfame potassium, sucralose, trisodium citrate, L-ascorbic acid, and a citrus flavorant (containing citral) were dissolved in ion exchange water to prepare a beverage composition having an alcohol concentration of 18 v/v% and a pH of about 2.9. The beverage composition was packed in one package and sterilized by immersion in heated water (at 60°C for 10 min.) to prepare a concentrated packaged beverage. Then, the prepared packaged beverage was stored under each of the conditions detailed above (condition 1 or 2) and then diluted with carbonated water (“Minami-Alps Tennensui Sparkling”, produced by Suntory Beverage & Food Limited) to an alcohol concentration of 9% to thereby prepare a fruit juice-containing alcoholic beverage (shochu-based beverage).

[0064] (2) 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 freshness of lemon 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 “freshness of lemon”.

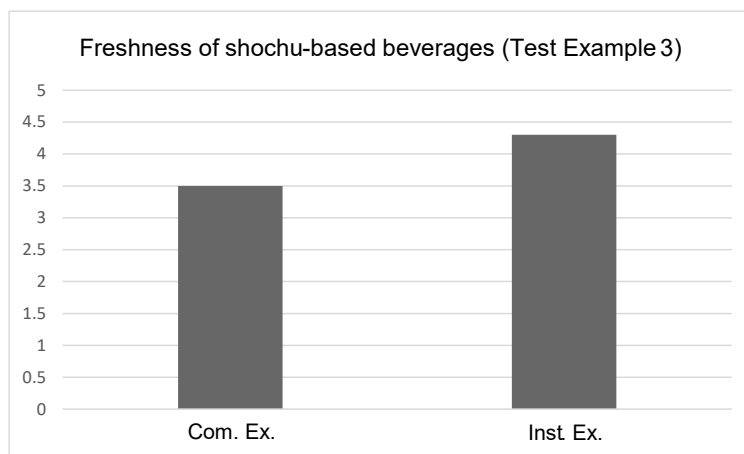
- 5 points: The freshness of lemon was strongly felt
- 4 points: The freshness of lemon was fully felt
- 3 points: The freshness of lemon was felt
- 2 points: The freshness of lemon was somewhat felt
- 1 point: The freshness of lemon was hardly felt at all
- 0 point: No freshness of lemon was felt

[0065] (3) Analysis results and aroma evaluation results

As a result of the evaluation on the “freshness of lemon” of the shochu-based beverages stored at 23°C for 20 days, it was confirmed that the beverage of Instant Example was rated 4.3 points (standard deviation: 0.68) whereas that of Comparative Example was rated 3.5 points (standard deviation: 0.71), and that the present invention can significantly enhance the “freshness of lemon” of a shochu-based beverage.

[0066] Further, the beverage of Instant Example had a citral concentration of 771 ppm (standard deviation: 0.96) whereas that of Comparative Example had a citral concentration of 13 ppm (standard deviation: 0.02) -- the citral concentration was about 60 times higher in Instant Example than in Comparative Example. Thus, it was confirmed that the present invention can significantly increase the citral content of a shochu-based beverage.

[0067] [Table 3]

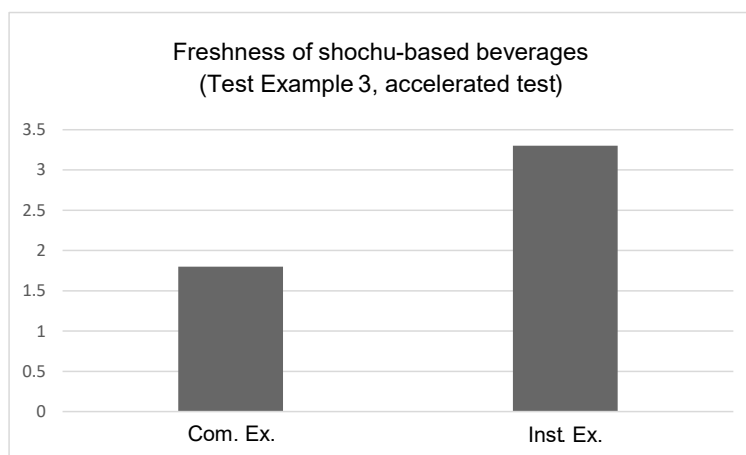


(Ordinary temp., 20 days)	Comparative Example	Instant Example
Citral (ppm)	13	771
Sensory rating	3.5	4.3

[0068] As a result of the evaluation on the “freshness of lemon” of the shochu-based beverages stored at 50°C for 6 days (accelerated test), it was confirmed that the beverage of Instant Example was rated 3.3 points (standard deviation: 0.52) whereas that of Comparative Example was rated 1.8 points (standard deviation: 0.69), and thus that the present invention can significantly enhance the “freshness of lemon” of a shochu-based beverage.

[0069] Further, as a result of the quantification of the citral concentration (total of neral and geranial concentrations) in the beverages of Instant and Comparative Examples by the same procedure as in Test Example 1, it was confirmed that the beverage of Instant Example had a citral concentration of 660 ppm (standard deviation: 0.73) whereas that of Comparative Example had a citral concentration of 5 ppm (standard deviation: 0.01) -- the citral concentration was really about 130 times higher in Instant Example than in Comparative Example -- and thus that the present invention can significantly increase the citral content of a shochu-based beverage.

[0070] [Table 4]



(50°C, 6 days)	Comparative Example	Instant Example
Citral (ppm)	5	660
Sensory rating	1.8	3.3

CLAIMS

1. A fruit juice beverage packed in a package, 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 at least one of the beverage compositions has a pH of 3.5 or more.
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 concentration of citral in a beverage composition packed in one beverage storage segment is higher 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 composition with a high citral concentration has a pH of 3.5 or more.
7. The beverage according to any of claims 1 to 6, wherein the concentration of citral 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.

8. The beverage according to any of claims 1 to 7, wherein at least one of the beverage compositions contains an alcohol.

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.