

DESCRIPTION

SODIUM-CONTAINING BEVERAGE

TECHNICAL FIELD

[0001] The present invention relates to a beverage containing sodium. More particularly, this invention relates to a sodium-containing beverage characterized in that a bad aftertaste derived from sodium is reduced.

BACKGROUND ART

[0002] In recent years, heatstroke has become a social problem, and sodium-containing beverages intended as a countermeasure against heatstroke have gained popularity in the beverage market during summer. However, there has conventionally been a problem that sodium-containing beverages have a bad aftertaste derived from sodium, which may adversely affect the palatability of the beverages. With a view to improving such a bad taste derived from sodium, various techniques have been reported, including: a technique of adjusting a ratio of citric acid concentration to phosphoric acid concentration in a beverage (PTL 1); a technique of incorporating fructose and malic acid in a beverage (PTL 2); and a technique of incorporating a specified amount of lauric acid in a beverage (PTL 3). However, these techniques solve the problem by limiting the types or concentrations of a sweetener and an acidulant to be used in a beverage, and thus impose restrictions on sweetness and sourness which serve as a basis for the taste of the beverage -- therefore, these techniques are only applicable to very limited types of beverages.

[0003] In the meantime, limonene is a class of monocyclic monoterpene compounds, and in some cases added to beverages mainly as a flavoring component. It is known that beverages having limonene added thereto often have a citrus fruit-like aroma.

CITATION LIST

PATENT LITERATURES

[0004] PTL 1: Japanese Unexamined Patent Application Publication No. JP 2019-76067

PTL 2: Japanese Unexamined Patent Application Publication No. JP 2015-167523

PTL 3: Japanese Unexamined Patent Application Publication No. JP 2016-7149

SUMMARY OF INVENTION

TECHNICAL PROBLEM

[0005] There has conventionally been a problem that sodium-containing beverages develop a bad aftertaste derived from sodium. In this regard, the present inventors found that a bad aftertaste is strongly perceived particularly in beverages containing sodium at concentrations of not less than 25 mg/100 mL. The inventors found, through their research, that the presence of limonene is effective for reducing a bad aftertaste derived from sodium. However, the inventors also found that in packaged beverages prepared with addition of limonene, limonene is degraded by exposure to light to generate an unpleasant odor (light degradation odor). Therefore, an object of the present invention is to provide a packaged beverage containing sodium at concentrations of not less than 25 mg/100 mL, the packaged beverage characterized in that a bad aftertaste derived from sodium is reduced and that a light degradation odor of limonene is suppressed.

SOLUTION TO PROBLEM

[0006] The present inventors have conducted intensive studies to achieve the aforementioned object, and as a result, found that when a specified amount of iron is added to a beverage in which a bad aftertaste derived from sodium is reduced by adding limonene, a light degradation odor of limonene in the beverage is suppressed. Based on this finding, the inventors have completed the present invention.

[0007] The present invention is directed, but not limited, to the following.

(1) A beverage packed in a package and comprising sodium, limonene and iron, the beverage having:

- (a) a sodium content of from 25 to 115 mg/100 mL,
- (b) a limonene content of not less than 20 ppm, and
- (c) an iron content of from 0.2 to 2.0 mg/100 mL.

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

ADVANTAGEOUS EFFECTS OF INVENTION

[0008] According to the present invention, there can be provided a packaged beverage containing sodium at concentrations of not less than 25 mg/100 mL, the packaged beverage characterized in that a bad aftertaste derived from sodium is reduced and that a light degradation odor of limonene is suppressed. According to this invention, there can be provided an easy-to-drink beverage in which a bad aftertaste derived from sodium is reduced regardless of the presence of high concentrations of sodium. The beverage of this invention comprises high concentrations of sodium and thus is useful as a beverage intended as a countermeasure against heatstroke.

[0009] Further, since the beverage of the present invention also comprises limonene but is characterized in that a light degradation odor of limonene is suppressed, this invention can provide a beverage that makes one perceive a citrus fruit-like aroma over a long period of time. The beverage of this invention is a packaged beverage that is less apt to make one perceive a light degradation odor of limonene, and can be drunk little by little over a long period of time while carried during trip. Through the use of the beverage of this invention, it is possible to achieve routine water replacement while taking a countermeasure against heatstroke.

DESCRIPTION OF EMBODIMENTS

[0010] Hereunder, the beverage of the present invention will be described. Unless otherwise specified, the terms “%” and “ppb” as used herein as the units for the contents of components refer respectively to % and ppm on a weight/weight (w/w) basis. All numerical ranges defined herein by lower and upper limits, *i.e.* defined as “from lower limit to upper limit”, include their lower and upper limits. For example, the range defined as “from 1 to 2” includes 1 and 2.

[0011] One embodiment of the present invention is directed to a beverage packed in a package and comprising sodium, limonene and iron, the beverage having:

- (a) a sodium content of from 25 to 115 mg/100 mL,
- (b) a limonene content of not less than 20 ppm, and
- (c) an iron content of from 0.2 to 2.0 mg/100 mL.

By adopting the aforementioned composition profile, a bad aftertaste derived from sodium as perceived upon drinking a sodium-containing beverage sodium can be reduced, and a light degradation odor of limonene can be suppressed.

[0012] (Sodium)

The beverage of the present invention comprises sodium. In this invention, sodium can be added to the beverage in the form of a salt that can be used in beverages and foods, or in the form of deep ocean water, seaweed essence, or the like which are rich in sodium. Examples of sodium salts that can be used in this invention include, but are not particularly limited to, sodium chloride, disodium citrate, trisodium citrate, sodium L-aspartate, sodium benzoate, sodium hydrogen carbonate, and trisodium phosphate. In this invention, sodium can be derived from such sodium salts. The beverage of this invention preferably comprises sodium chloride. In this invention, sodium is preferably derived from sodium chloride.

[0013] The sodium content in the beverage of the present invention is in the range of from 25 to 120 mg/100 mL. It is known that consumption of a specified amount of sodium is desirable for effectively replacing water in the body and is particularly effective as, for example, a countermeasure against heatstroke. However, when the sodium content in the beverage is 25 mg/100 mL or more, a bad aftertaste derived from sodium is prominently perceived. As referred above, the “bad aftertaste derived from sodium” refers to a rough aftertaste lingering after drinking a sodium-containing beverage.

[0014] In the present invention, the sodium content in the beverage is in the range of from 25 to 120 mg per 100 mL of the beverage. The sodium content is in the range of preferably from 30 to 80 mg/100 mL, more preferably from 35 to 70 mg/100 mL, still more preferably from 40 to 60 mg/100 mL. When the sodium content in the beverage is less than 25 mg/100 mL, the efficiency of water replacement in the body may be deteriorated, and prevention of heatstroke may not be fully achieved. In contrast, when the sodium content in the beverage is more than 120 mg/100 mL, a bad aftertaste derived from sodium becomes too strong, so that the palatability of the beverage may be deteriorated or the effect of this invention may not be fully obtained.

[0015] In the present invention, when sodium is in the form of a salt, the sodium content in the beverage can be calculated in terms of the content of its free form. Further, the sodium content in the beverage can be measured by a known procedure using an ICP optical emission spectrometer.

[0016] (Limonene)

The beverage of the present invention comprises limonene, and has a limonene content of not less than 20 ppm. As mentioned above, by incorporating limonene in the beverage, a bad aftertaste derived from sodium as perceived when drinking a beverage comprising 25 mg/100 mL of sodium can be reduced. Limonene is a class of monocyclic monoterpenes and represented by the chemical formula $C_{10}H_{16}$. Limonene can be d-limonene or l-limonene, or a mixture thereof. Additionally, when a mixture of d-limonene and l-limonene is used as limonene, the limonene content as referred to herein refers to a total content of d-limonene and l-limonene.

[0017] The type of limonene to be used in the present invention is not particularly limited, and a purified product of limonene or a crudely purified product of limonene may be used. For example, a limonene-containing natural product or a processed product thereof (*e.g.*, plant extract, essential oil, fermented plant product, or their concentrates) may be used. More specific examples include limonene-containing flavorings, fruit juices, and essences. One preferred example is a limonene-containing flavoring, because only a small amount of it needs to be added to the beverage. The type of a flavoring is not particularly limited, but a citrus flavoring is preferred. Among citrus flavorings, an orange flavoring, a lemon flavoring, and a grapefruit flavoring are more preferred, with a grapefruit flavoring being most preferred.

[0018] The limonene content in the beverage of the present invention is not less than 20 ppm, and is preferably in the range of from 20 to 100 ppm, more preferably from 25 to 80 ppm, particularly preferably from 30 to 60 ppm. When the limonene content falls within the aforementioned range, a bad aftertaste derived from sodium can be effectively reduced. The limonene content can be measured by a known procedure using gas chromatography.

[0019] In the beverage of the present invention, the ratio of limonene content (mg/100 mL) to sodium content (mg/100 mL) (limonene content/sodium content) is not particularly limited, and is, for example, not less than 1, preferably not less than 4, more preferably not less than 5, still more preferably not less than 10. Also, the ratio of limonene content (mg/100 mL) to sodium content (mg/100 mL) (limonene content/sodium content) is not particularly limited, and is, for example, not more than 50, preferably not more than 30, more preferably not more than 20, still more preferably not more than 15.

[0020] (Iron)

The beverage of the present invention comprises iron, and has an iron content of from 0.2 to 2.0 mg/100 mL. As mentioned above, by incorporating iron in the beverage, the occurrence of a light degradation odor of limonene present in a sodium-containing beverage can be suppressed. The mechanism for this effect is unknown. Without wishing to be bound by any particular theory, it is considered that during the reaction in a limonene oxidation pathway, iron present in a beverage serves to rapidly convert degraded limonene components such as limonene 1,2-diol into different components.

[0021] In the present invention, iron can be added to the beverage in the form of a food containing iron, an iron compound acceptable as a food additive, or a composition comprising an iron compound. In this invention, since the iron concentration in the beverage can be adjusted easily, it is preferable to add iron to the beverage in the form of an iron compound acceptable as a food additive, or a composition comprising an iron compound. Examples of an iron compound acceptable as a food additive include, but are not particularly limited to, ferric chloride, ammonium ferric citrate, ferric pyrophosphate, sodium ferrous citrate, and ferrous gluconate. In this invention, iron can be derived from such iron compounds. In this invention, ferric iron is particularly preferred from the viewpoint of its capability of suppressing the occurrence of a light degradation odor of limonene. Examples of ferric iron compounds include, but are not particularly limited to, ferric chloride, ammonium ferric citrate, and ferric pyrophosphate. In this invention, ferric pyrophosphate is a particularly preferred ferric iron compound from the viewpoint of its

suitability for the flavor of beverages. In other words, the beverage of this invention preferably comprises ferric pyrophosphate. In this invention, ferric iron is preferably derived from ferric pyrophosphate. However, in this invention, polymeric iron complexes such as sugar-containing iron oxides are not preferred iron compounds because iron ions are unlikely to be liberated in a beverage.

[0022] In the present invention, the iron content in the beverage is in the range of from 0.2 to 2.0 mg per 100 mL of the beverage. The iron content is preferably in the range of from 0.3 to 1.2 mg/100 mL, more preferably from 0.4 to 0.6 mg/100 mL, still more preferably from 0.5 to 0.6 mg/100 mL. When the iron content in the beverage is less than 0.2 mg/100 mL, suppression of the occurrence of a light degradation odor of limonene may not be fully obtained. In contrast, when the iron content is more than 2.0 mg/100 mL, the taste of iron tends to become too strong, leading to deterioration of the palatability of the beverage.

[0023] In the present invention, when iron is added in the form of an iron compound, the iron content in the beverage can be calculated in terms of the content of its free form. Further, the iron content in the beverage can be measured by a known procedure using an ICP optical emission spectrometer. Additionally, when the beverage is pretreated, if necessary, by ashing, etc., the measurement accuracy can be enhanced. The content of ferrous iron or ferric iron in the beverage can be measured using wavelength-dispersive X-ray fluorescence.

[0024] In the beverage of the present invention, the ratio of iron content (mg/100 mL) to limonene content (mg/100 mL) (iron content/limonene content) is not particularly limited, and is, for example, not less than 0.03, preferably not less than 0.04, more preferably not less than 0.05, still more preferably not less than 0.06. The ratio of iron content (mg/100 mL) to limonene content (mg/100 mL) (iron content/limonene content) is not particularly limited, and is, for example, not more than 0.2.

[0025] (Other components)

Similarly to common beverages, the beverage of the present invention may have

added thereto different additives, including sweeteners, acidulants, minerals other than sodium and iron, fruit juices, flavorings, pigments, antioxidants, emulsifiers, preservatives, seasonings, essences and pH adjustors, to the extent that they do not impair the effect of this invention. Further, it is preferable, without particular limitation, that the beverage of this invention should not contain milk or defatted powdered milk, because milk protein present in milk or defatted powdered milk may interfere with improvement of a bad aftertaste derived from sodium.

[0026] (pH)

The pH of the beverage of the present invention is not particularly limited, and is in the range of, for example, from pH 2 to 8, preferably from pH 2 to 7, more preferably from pH 2.5 to 6, still more preferably from pH 3 to 5. When the beverage of this invention has a pH of from 3 to 5, there is a tendency that a moderate sour taste contributes to the ease of drinking of an iron-containing beverage.

[0027] The pH of the beverage of the present invention can be adjusted using, for example, but not particularly limited to, an organic acid such as citric acid, malic acid, lactic acid or phosphoric acid, a sodium salt such as disodium citrate, trisodium citrate, sodium hydrogen carbonate or sodium hydroxide, or a potassium salt such as potassium hydroxide or potassium carbonate. When a sodium salt is used for pH adjustment, the amount of the sodium salt used as a pH adjustor is adjusted while ensuring that the concentration of sodium in the beverage falls within the aforementioned range.

[0028] (Brix)

The Brix of the beverage of the present invention is not particularly limited, and is, for example, not more than 15%, preferably in the range of from 1 to 9%, more preferably more preferably from 2 to 6%, still more preferably from 3 to 5%. When the Brix of the beverage exceeds 15%, the effect of this invention may not be fully exhibited. The Brix of the beverage can be adjusted by adding a sweetener or the like to the beverage. The Brix of the beverage can be measured using a commercially available sugar content meter, refractometer or the like. As referred to herein, the "Brix" refers to 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”.

[0029] (Protein)

The protein concentration in the beverage of the present invention is not particularly limited, and is, for example, less than 4%, preferably less than 2%. When the protein concentration in the beverage is not less than 4%, improvement of a bad aftertaste derived from sodium may not be fully obtained.

[0030] (Type of beverage)

The type of the beverage of the present invention is not particularly limited. The beverage of this invention can be an alcoholic beverage or a non-alcoholic beverage such as soft drink. Since the beverage of this invention is preferably a beverage intended as a countermeasure against heatstroke, the beverage of this invention is preferably a non-alcoholic beverage. As referred to in this invention, the “alcoholic beverage” refers to a beverage having an alcohol content of not less than 1 v/v%, and the “non-alcoholic beverage” refers to a beverage having an alcohol content of less than 1 v/v%. Examples of non-alcoholic beverages include, but are not particularly limited to, functional beverages, nutritional beverages, flavored water (near water) beverages, sport drinks, tea beverages (*e.g.*, grain tea, green tea, oolong tea, black tea, blended tea), coffee beverages, and carbonated beverages. Since the beverage of this invention is preferably a beverage intended as a countermeasure against heatstroke, the beverage of this invention is preferably a nutritional beverage, a functional beverage, a flavored water (near water) beverage, a sport drink, or a tea beverage, particularly preferably a sport drink. As referred to herein, the “beverage intended as a countermeasure against heatstroke” refers to a beverage suitable for taking a countermeasure against heatstroke. As referred to above, the “countermeasure against heatstroke” refers to prevention of the onset of heatstroke or alleviation of the symptoms of heatstroke. Judgment of whether the beverage is intended as a countermeasure against

heatstroke can be made by, for example, looking at a product name or label on a container or package, or by seeing a product poster, a TV advertisement or a pop-up advertisement in store, or by reading product descriptions in a briefing.

[0031] (Package)

The beverage of the present invention is a beverage packed in a package. The type of the package used is not particularly limited, but a clear package is preferred. Beverages packed in clear packages are susceptible to exposure to light. It was found that limonene contained in beverages are degraded by exposure to light to generate an unpleasant odor (light degradation odor). In this invention, however, such a light degradation odor can be suppressed. From the viewpoint of storage stability, a beverage packed in a clear package is one of preferred embodiments of this invention.

[0032] Examples of clear packages include packages having a transmittance of not less than 40%, preferably not less than 50%, in a visible light spectrum of 700 nm. Specific examples thereof include clear plastic bottles and clear glass bottles, with clear PET bottles being particularly preferably used in the present invention. The color of a package is not particularly limited, but a colorless package is preferred.

[0033] A clear package may be partially or wholly covered with a film or the like. For example, use can be made of a package in which a label or a printed part indicating the contents is opaque or translucent whereas the other part is clear, or a package in which clear or opaque parts having design properties are combined to be located differentially in some places, or an opaque package having only a clear part with a size comparable to that of a viewing panel -- the area of a clear part in a package is not limited.

[0034] (Production method)

Another embodiment of the present invention is directed to a method for producing a beverage packed in a package and comprising sodium, limonene and iron, the method comprising the steps of:

- (a) adjusting a sodium content to be in the range of from 25 to 115 mg/100 mL;
- (b) adjusting a limonene content to be not less than 20 ppm; and

(c) adjusting an iron content to be in the range of from 0.2 to 2.0 mg/100 mL.

[0035] The beverage of the present invention can be produced by mixing the aforementioned components in appropriate amounts. During the process of production of the beverage of this invention, the order of adding components is not particularly limited. The production method for the beverage of this invention can also comprise the steps of mixing the components and materials described above and adjusting their contents. Various parameters associated with the production of the beverage of this invention, such as the types and contents of the components contained in the beverage, are as described above in relation to the beverage of this invention or are obvious from the descriptions given above.

[0036] Further, the production method for the beverage of the present invention comprises a packaging step of packing the beverage in a package and may also comprise an optional step of heat sterilizing the beverage. By going through these steps, the beverage of this invention can be made into a packaged beverage. The step of heat sterilizing the beverage may be performed before or after the step of packing the beverage in a package. The package used to pack the beverage is not particularly limited, and examples of the package that can be used include plastic bottle (*e.g.*, PET bottle), aluminum can, steel can, paper package, cup for chilled drink, and glass bottle. As mentioned above, the package used is preferably a clear package. When heat sterilization is performed, the method of heat sterilization is not particularly limited. Heat sterilization can be performed using a common method such as UHT sterilization or retort sterilization. The temperature of the heat sterilization process is not particularly limited, and is in the range of, for example, from 65 to 140°C, preferably from 85 to 120°C. The time of the heat sterilization process is not particularly limited, and is in the range of, for example, from 10 to 40 minutes. However, any other heat sterilization process may also be performed at an appropriate temperature for several seconds, such as 5 to 30 seconds, as long as such a process can achieve a comparable sterilizing value to that process under the aforementioned conditions.

EXAMPLES

[0037] Hereunder, the present invention will be specifically described in detail by way of

experimental examples, but this invention is not limited to these examples. Unless otherwise stated herein, all numerical ranges are inclusive of their endpoints.

[0038] <Experimental Example 1>

Sodium chloride or trisodium citrate was added to pure water, and limonene was further added thereto, to thereby prepare different beverage samples having such final sodium and limonene concentrations as indicated in the table given below. The beverage samples were heat sterilized and then packed in 500 mL PET bottles to produce packaged beverages. The different beverage samples had a Brix of less than 1.

[0039] The prepared beverage samples were subjected to sensory evaluation by six professional panelists. In this sensory evaluation, the beverage samples were evaluated for a bad (rough) aftertaste derived from sodium lingering after drinking according to the evaluation scale detailed below. The sensory ratings were first given by each panelist on his/her own, and then finally determined through discussion among all the panelists.

×: A rough aftertaste is perceived.

△: A rough aftertaste is not quite perceived.

○: No or almost no rough aftertaste is perceived.

[0040] Further, the above-prepared limonene-containing beverage samples were irradiated with ultraviolet light at 180 Wh/m² for 2 hours and 20 minutes using the Super Xenon Weather Meter (producing by Suga Test Instruments Co., Ltd.; equipped with a 7.5 kW xenon lamp). The aforementioned irradiation conditions are equivalent to those under which a beverage is left outdoors for a period of two fine days. Thereafter, the beverage samples irradiated with UV light were subjected to sensory evaluation for degradation odor of limonene according to the evaluation scale detailed below. The sensory evaluation was conducted by six professional panelists. The sensory ratings were first given by each panelist on his/her own, and then finally determined through discussion among all the panelists.

×: A degradation odor of limonene is perceived more strongly than in a beverage sample before UV irradiation.

△: A degradation odor of limonene is perceived somewhat more strongly than in a beverage sample before UV irradiation.

○: A degradation odor of limonene is less perceived than in a beverage sample before UV irradiation.

[0041]

[Table 1]

	1-1	1-2	1-3	1-4	1-5	1-6	1-7	1-8	1-9	1-10
Sodium chloride (g/L)	0	0.52	0.78	1.3	2.08	1.3	1.3	1.3	0	2.08
Trisodium citrate (g/L)	0	0	0	0	0	0	0	0	2.18	0
Na content (mg/100 mL)	0	20	30	50	80	50	50	50	50	80
Limonene (ppm)	0	0	0	0	0	20	60	100	60	20
Limonene/Na	—	—	—	—	—	4	12	20	12	2.5
Sensory rating (bad aftertaste derived from Na)	○	○	△	×	×	○	○	○	○	○
Sensory rating (degradation odor of limonene)	—	—	—	—	—	△	×	×	×	△

[0042] The results are as shown in the above table. In the sodium-containing beverage samples prepared with no addition of limonene, a bad (rough) aftertaste derived from sodium was perceived after drinking. In contrast, in the sodium-containing beverage samples prepared with addition of limonene at concentrations of not less than 20 ppm, such a bad (rough) aftertaste lingering after drinking was reduced. In those samples containing limonene at concentrations of not less than 60 ppm, almost no rough aftertaste was perceived after drinking. However, it was found that the sodium-containing beverage samples prepared with addition of limonene generated a degradation odor of limonene after irradiation with ultraviolet light.

[0043] <Experimental Example 2>

Sodium chloride and limonene were added to pure water, and ferric pyrophosphate (Sun Active Fe-12A, produced by Taiyo Kagaku Co., Ltd.) was further added thereto to prepare different beverage samples having such final sodium, limonene and iron concentrations as indicated in the table given below. The beverage samples were heat sterilized and then packed in 500 mL PET bottles to produce packaged beverages. The different beverage samples had a Brix of less than 1.

[0044] Like in Experimental Example 1, the prepared beverage samples were irradiated with ultraviolet light at 180 Wh/m² for 2 hours and 20 minutes using the Super Xenon Weather Meter (producing by Suga Test Instruments Co., Ltd.; equipped with a 7.5 kW xenon lamp). Thereafter, the beverage samples were subjected to sensory evaluation for degradation odor of limonene according to the evaluation scale detailed below. The sensory evaluation was conducted by six professional panelists. The sensory ratings given by the panelists were averaged to calculate average ratings.

- 1: A degradation odor of limonene is comparable to that of Sample 2-1.
- 2: A degradation odor of limonene is somewhat weaker than that of Sample 2-1.
- 3: A degradation odor of limonene is weaker than that of Sample 2-1.
- 4: A degradation odor of limonene is significantly weaker than that of Sample 2-1.
- 5: No degradation odor of limonene is perceived.

[0045] [Table 2]

	2-1	2-2	2-3	2-4	2-5	2-6
Na content (mg/100 mL)	50	50	50	50	50	50
Limonene (ppm)	60	60	60	60	60	60
Na content (mg/100 mL)	0	0.2	0.3	0.4	0.6	1.2
Iron/limonene	0	0.03	0.05	0.07	0.1	0.2
Sensory rating (degradation odor of limonene)	1 (Reference)	3.2	3.7	4.2	4.7	4.8

[0046] The results are as shown in the above table. It was found that in the beverage samples containing iron at concentrations of not less than 0.2 mg/100 mL, a degradation odor of limonene generated by UV irradiation was reduced. Additionally, in all of the beverage samples, no or almost no bad (rough) aftertaste derived from sodium was perceived.

[0047] <Experimental Example 3>

Different beverage samples having such final sodium, limonene and iron concentrations as indicated in the table given below were prepared by following the same procedure as in Experimental Example 2. The beverage samples were heat sterilized and then packed in 500 mL PET bottles to produce packaged beverages. The different beverage samples had a Brix of less than 1.

[0048] Like in Experimental Example 1, the prepared beverage samples were irradiated with ultraviolet light at 180 Wh/m² for 2 hours and 20 minutes using the Super Xenon Weather Meter (producing by Suga Test Instruments Co., Ltd.; equipped with a 7.5 kW xenon lamp). Thereafter, the beverage samples were subjected to sensory evaluation for a degradation odor of limonene by following the same procedure as in Experimental Example 2. The beverage samples were compared in terms of a degradation odor of limonene, with Sample 3-1 being used as a reference for comparison with Sample 3-2, and Sample 3-3 being used as a reference for comparison with Sample 3-4.

[0049] [Table 3]

	3-1	3-2	3-3	3-4
Na content (mg/100 mL)	50	50	50	50
Limonene (ppm)	20	20	100	100
Na content (mg/100 mL)	0	0.4	0	0.4
Iron/limonene	0	0.2	0	0.04
Sensory rating (degradation odor of limonene)	1 (Reference)	4.3	1 (Reference)	4.3

[0050] The results are as shown in the above table. It was found that in both of the beverage samples with limonene contents of 20 ppm and 100 ppm, a degradation odor of limonene was reduced by addition of iron. Additionally, in both of Samples 3-2 and 3-4, no or almost no bad (rough) aftertaste derived from sodium was perceived.

[0051] <Experimental Example 4>

Two different acidic beverage samples were prepared by mixing different components as indicated in the table given below. It should be noted that the concentrations of different components as indicated in the table below refer to final concentrations of the components present in beverage samples. The prepared acidic beverage samples were heat sterilized and then packed in 500 mL PET bottles to produce packaged beverages. The produced beverage samples had a pH of 3.5 and a Brix of 4.

[0052] Like in Experimental Example 1, the above packaged beverage samples were irradiated with ultraviolet light at 180 Wh/m² for 2 hours and 20 minutes using the Super Xenon Weather Meter (producing by Suga Test Instruments Co., Ltd.; equipped with a 7.5 kW xenon lamp). Thereafter, the beverage samples were subjected to sensory evaluation for a degradation odor of limonene by following the same procedure as in Experimental Example 2. The beverage samples were compared in terms of a degradation odor of limonene, with Sample 4-1 being used as a reference for comparison with Sample 4-2.

[0053] [Table 4]

	4-1	4-2
Fructose glucose syrup (g/L)	55	55
Citric acid (g/L)	1.7	1.7
Sodium chloride (g/L)	0.66	0.66
Trisodium citrate (g/L)	0.63	0.63
Grapefruit flavoring (g/L)	5	5
Ferric pyrophosphate (g/L)	0	0.425
Na content (mg/100 mL)	40	40
Limonene (ppm)	60	60
Na content (mg/100 mL)	0	0.5
Limonene/Na	15	15
Iron/limonene	0	0.08
Sensory rating (degradation odor of limonene)	1 (Reference)	4.3

[0054] The results are as shown in the above table. It was found that also in the acidic beverage samples, a degradation odor of limonene was reduced by addition of iron. Additionally, no or almost no bad (rough) aftertaste derived from sodium was perceived in Sample 4-2.

CLAIMS

1. A beverage packed in a package and comprising sodium, limonene and iron, the beverage having:
 - (a) a sodium content of from 25 to 115 mg/100 mL,
 - (b) a limonene content of not less than 20 ppm, and
 - (c) an iron content of from 0.2 to 2.0 mg/100 mL.
2. The beverage according to claim 1, wherein the package is a clear package.