

DESCRIPTION

Title of Invention: METHOD FOR MANUFACTURING BEVERAGE CONTAINING
PROCESSED EDIBLE-PLANT POWDER HAVING IMPROVED DISPERSION
STABILITY OR REDISPERSABILITY

5

Technical Field

[0001]

The present invention relates to a beverage containing
a powdery, edible, processed plant product, wherein the
10 dispersion stability of an insoluble solid material (powdery,
edible, processed plant product) is improved so that the
sedimentation of the material is suppressed, and the
redispersibility is improved so that the initial dispersion state
can easily be recovered by lightly shaking the beverage when
15 sedimentation has occurred. The present invention also relates to
a method for producing the beverage.

[0002]

The present invention further relates to a method for
improving the dispersion stability of an insoluble solid material
20 (powdery edible processed plant product) in a beverage, and also
relates to a method for improving the redispersibility so that
the initial dispersion state is easily recovered by lightly
shaking the beverage when sedimentation has occurred.

25 Background Art

[0003]

Because of its deep, natural flavor, matcha (powdered
green tea) has been consumed as a beverage and used as a
component for beverages, as well as used as an additive to a
30 variety of foods and drinks. With today's growing health
consciousness, dry powders of green-and-yellow vegetables, such
as kale and barley (young grass), have also been consumed as a
beverage, and used as a component for beverages and an additive
to a variety of foods and drinks.

35 [0004]

However, these dry powders, which are water-insoluble solid materials (insoluble solid materials), are disadvantageous in that when they are contained in beverages, especially when such beverages are packed into containers and distributed to the market as packaged beverages, the powders settle out (sedimentation), or coagulate and solidify on the bottom of the containers during distribution or storage. Further, the sterilization treatment conducted in the production process of such packaged beverages causes the dry powders of green-and-yellow vegetables to undergo fading or change of their bright color. This problem, as well as the sedimentation problem, causes spoilage of the appearance and flavor (texture) of the beverages. [0005]

Typically used methods to solve these problems are those for suppressing the sedimentation of an insoluble solid material using a stabilizer such as cellulose and polysaccharide thickeners. Other proposed methods include a method for improving the retention of green color of powdered green tea or the dispersibility and solubility of powdered green tea in an aqueous medium by mixing the powdered green tea with maltose and a calcium preparation derived from, for example, oyster shells, and adding the mixture to foods and drinks (Patent Document 1); and a method for stabilizing the dispersion of an insoluble solid material, such as powdered green tea, by adding a stabilizer and hot or non-hot water to the insoluble solid material, homogenizing the mixture at a pressure of 100 to 250 kg/cm² to colloidally disperse the stabilizer in the mixture, and allowing the insoluble solid material to be held in the colloid (Patent Document 2). However, the use of a stabilizer or the like may cause unnatural texture and flavor in a beverage. The use of a stabilizer also increases the cost of the beverage. [0006]

As a method not using a stabilizer, there has been proposed a method for suppressing the sedimentation and coagulation of an insoluble solid material in a beverage by

dispersing a green tea powder having a mean particle diameter of 7 to 20 μm in water, and homogenizing the mixture at 20 to 90°C at a pressure of 5 MPa or more (Patent Document 3). However, this method can only be applied to a green tea powder having a mean particle diameter ranging from 7 to 20 μm , and thus preadjustment of the mean particle diameter of the powder is required; hence, the method is cumbersome and impractical.

Citation List

Patent Document

[0007]

Patent Document 1: JP2003-259805A

Patent Document 2: JP2001-029053A

Patent Document 3: JP2007-053913A

15

Summary of Invention

Technical Problem

[0008]

An object of the present invention is to solve the above-described conventional problems. Specifically, an object of the present invention is to provide a beverage containing a powdery edible processed plant product, wherein, preferably without using a stabilizer, the dispersion stability of the insoluble solid substance (powdery edible processed plant product) is improved so that the sedimentation is suppressed, and the redispersibility is improved so that the initial dispersion state is easily recovered by light shaking when sedimentation has occurred. An object of the present invention is also to provide a method for producing the beverage.

30 [0009]

Further, an object of the present invention is to provide a method for improving, preferably by not using a stabilizer, the dispersion stability of an insoluble solid material (powdery edible processed plant product) in a beverage and a method for improving the redispersibility so that the

35

initial dispersion state is easily recovered by light shaking when sedimentation has occurred.

Solution to Problem

5 [0010]

The present inventors conducted extensive research to solve the above-described problems, and found that in the production of a beverage containing a powdery edible processed plant product, when a dispersion prepared by mixing a powdery edible processed plant product with fat and oil, rather than a
10 powdery edible processed plant product *per se*, is added to water for beverage preparation, the resulting beverage shows significantly improved dispersion stability of the powdery edible processed plant product so that the sedimentation that occurs
15 over time is suppressed, and also shows significantly improved redispersibility of the generated sediment so that the initial dispersion state is easily recovered by light shaking, as compared to beverages prepared by adding a powdery edible processed plant product *per se* to water for beverage preparation
20 (hereinafter, the latter beverages are referred to as "control beverage").

[0011]

The present invention was completed based on these findings, and includes the following embodiments.

25 [0012]

(I) Method for Producing Beverage Containing Powdery Edible Processed Plant Product

(I-1) A method for producing a beverage containing a powdery edible processed plant product, the method comprising the steps
30 of:

- (a) mixing a powdery edible processed plant product with fat and oil to thereby form a dispersion; and
- (b) mixing the dispersion of the powdery edible processed plant product in the fat and oil with water, and homogenizing the
35 mixture.

(I-2) The method according to item (I-1), further comprising a homogenization step between step (a) and step (b).

(I-3) The method according to item (I-1) or (I-2), wherein the water used in step (b) contains milk or one or more dairy

5 components.

(I-4) The method according to any one of items (I-1) to (I-3), the method not comprising adding a stabilizer and/or an emulsifier.

(I-5) The method according to any one of items (I-1) to (I-4),
10 wherein the powdery edible processed plant product is a dry powder of at least one type of plant selected from the group consisting of tea, vegetables, fruits, grain, and beans.

(I-6) The method according to any one of items (I-1) to (I-5), wherein the dispersion obtained in step (a) does not contain
15 water other than water from the fat and oil and the edible processed plant product used as starting materials.

[0013]

(II) Beverage Containing Powdery Edible Processed Plant Product

(II-1) A beverage, which is obtained by the method according to
20 any one of items (I-1) to (I-6), the beverage containing at least a powdery edible processed plant product, fat and oil, and water, the beverage showing at least improved dispersion stability of the powdery edible processed plant product, or improved redispersibility of the powdery edible processed plant product,
25 as compared to a beverage prepared without conducting step (a) of mixing a powdery edible processed plant product with fat and oil to form a dispersion.

(II-2) The beverage according to item (II-1), which shows suppressed color fading or color change of the powdery edible
30 processed plant product.

[0014]

(III) Method for Improving Dispersion Stability or Redispersibility of Powdery Edible Processed Plant Product in Beverage

35 (III-1) A method for improving dispersion stability or

redispersibility of a powdery edible processed plant product in a beverage, the method comprising, in production of the beverage containing the powdery edible processed plant product,

the step of mixing a prepared dispersion of the powdery edible processed plant product in fat and oil with water, and
5 homogenizing the mixture.

(III-2) A method for improving dispersion stability or redispersibility of a powdery edible processed plant product in a beverage, the method comprising, in production of the beverage
10 containing the powdery edible processed plant product, the steps of (a) dispersing the powdery edible processed plant product in fat and oil; and (b) mixing the dispersion of the powdery edible processed plant product in the fat and oil with water and homogenizing the mixture.

15 (III-3) The method according to item (III-2), further comprising a homogenization step between step (a) and step (b).

(III-4) The method according to any one of items (III-1) to (III-3), wherein the water contains milk or one or more dairy components.

20 (III-5) The method according to any one of items (III-1) to (III-4), the method not comprising adding a stabilizer and/or an emulsifier.

(III-6) The method according to any one of items (III-1) to (III-5), wherein the powdery edible processed plant product is a dry
25 powder of at least one type of plant selected from the group consisting of tea, vegetables, fruits, grain, and beans.

(III-7) The method according to any one of items (III-1) to (III-6), wherein the dispersion obtained by dispersing the powdery edible processed plant product in the fat and oil does not
30 contain water other than water from the fat and oil and the edible processed plant product used as starting materials.

(III-8) The method according to any one of items (III-1) to (III-7), which improves dispersion stability or redispersibility of the powdery edible processed plant product in the beverage, while
35 suppressing color fading of the powdery edible processed plant

product in the beverage.

Advantageous Effects of Invention

[0015]

5 The production method and the method for improving the dispersion stability or redispersibility according to the present invention can improve, preferably without using a stabilizer or an emulsifier, the dispersion stability of an insoluble solid material (powdery edible processed plant product) in a beverage
10 containing the powdery edible processed plant product such as powdered green tea, and the redispersibility so that the initial dispersion state is easily recovered by light shaking when sedimentation has occurred, as compared to a beverage prepared without conducting a step of mixing a powdery edible processed
15 plant product with fat and oil to form a dispersion. Moreover, in the use of a green-and-yellow vegetable, particularly a vegetable containing a green pigment (i.e., chlorophyll) as an edible processed plant product, the production method according to the present invention can suppress the color fading or color change
20 of the powdery edible processed plant product in a beverage, which is caused by heat sterilization or storage, as compared to a beverage prepared without conducting the step of mixing a powdery edible processed plant product with fat and oil to form a dispersion.

25

Brief Description of Drawings

[0016]

Fig. 1 shows the results of Experimental Example 5.
(A) An alternative figure for a color image showing the state of
30 samples observed after being prepared and allowed to stand for 20 minutes. (B) An alternative figure for a color image showing the state of samples observed after being prepared, allowed to stand for 20 minutes, and centrifuged. Both Figs. 1(A) and 1(B) show on the left an image of sample (1) prepared by dispersing powdered
35 green tea in water without dispersing the powdered green tea in

fat and oil beforehand (Control Sample), and show on the right an image of sample (2) prepared by dispersing powdered green tea in fat and oil (the Example).

5 Description of Embodiments

[0017]

(I) Method for Producing Beverage Containing Powdery Edible
Processed Plant Product

10 The present invention relates to a method for producing a beverage containing a powdery edible processed plant product, wherein at least the dispersion stability of the powdery edible processed plant product is improved, or the redispersibility of the powdery edible processed plant product is improved.

[0018]

15 The production method can be carried out by at least the following steps (a) and (b):

- (a) mixing a powdery edible processed plant product with fat and oil to form a dispersion; and
 - (b) mixing the dispersion of the powdery edible processed plant product in the fat and oil with water, and homogenizing the mixture.
- 20

[0019]

The following describes each step.

Step (a): Dispersion Step

25 The term "powdery edible processed plant product" as used in step (a) refers to a water-insoluble edible processed plant product prepared as a powder. Specifically, the powdery edible processed plant product refers to those prepared by grinding the edible part of plants such as fruits, vegetables
30 (root vegetables, stem and bulb vegetables, leaf vegetables, flower vegetables, and fruit vegetables) and tea leaves, and preferably dry powders thereof. The powdery edible processed plant product according to the present invention may be those prepared from one type of edible plants, or a mixture prepared by
35 combining any two or more types of edible plants. The term

"powdery" in the present invention refers to not only those having a powdery shape, but those processed in the form of granules or solids (e.g., tablets) from a powder.

[0020]

5 The vegetables are not particularly limited, and include any of root vegetables (e.g., carrots, burdock roots, and radishes), stem and bulb vegetables (e.g., asparagus, onions, and purple onions), leaf vegetables (e.g., spinach, kale, barley (young grass), cabbage, Chinese cabbage, parsley, basil, mugwort, 10 watercress, *Angelica keiskei*, mulukhiyah, shiso (*Perilla frutescens* var. *crispa*), and egoma (*Perilla frutescens* var. *frutescens*)), , flower vegetables (e.g., cauliflower, and broccoli), and fruit vegetables (e.g., bell peppers, paprika, tomatoes, and pumpkin); 15 and are preferably green-and-yellow vegetables. Among green-and-yellow vegetables, preferable are green vegetables such as spinach, kale, barley (young grass), parsley, basil, mugwort, watercress, *Angelica keiskei*, komatsuna (*Brassica rapa* var. *perviridis*), broccoli, bell peppers, mulukhiyah, shiso (*Perilla frutescens* var. *crispa*), and egoma (*Perilla frutescens* var. *frutescens*); and more preferable are kale and barley (young grass), which are typically used in green juice.

[0021]

 Preferable examples of powdery tea leaves include 25 matcha (powdered green tea), which is a powder of *tencha*. Matcha is typically prepared as follows. Shade-grown tea leaves (ooishita leaves) are steamed, cooled, and dried without rolling, and the obtained dry leaves are broken into small pieces, followed by removal of the stems, petioles, and leaf veins. The 30 resultant product is further dried to prepare *tencha*, which is then ground to a powder (fine powder) with a mill.

[0022]

 The powdery edible processed plant product of interest in the present invention is preferably powdered green tea 35 (matcha) and a dry powder of a leaf vegetable selected from the

group consisting of kale, barley (young grass), komatsuna (*Brassica rapa* var. *perviridis*), and spinach, more preferably powdered green tea, kale, and barley (young grass), and further more preferably powdered green tea.

5 [0023]

The particle diameter of the powdery edible processed plant product (insoluble solid material) used in the present invention is not particularly limited; for example, the median diameter (count median diameter) of the dry product is 5 μm or
10 more, preferably 10 to 150 μm , more preferably 10 to 100 μm , further more preferably 10 to 80 μm , and still further more preferably 20 to 50 μm . The count median diameter can be measured in accordance with a laser diffraction scattering technique using a device such as a SALD-2200 (Shimadzu Corporation) laser
15 diffraction particle diameter distribution analyzer.

[0024]

The "fat and oil" as used in step (a) is not particularly limited. Examples thereof include fat and oil typically used in foods. Specifically, the fat and oil is a
20 vegetable oil (e.g., coconut oil, soybean oil, canola oil, cottonseed oil, corn oil, sunflower oil, and safflower oil) and an animal fat and oil (e.g., beef tallow, lard, and milk fat), and preferably fat and oil having a melting point of room temperature (15 to 25°C) or less. In other words, fat and oil in
25 liquid form at room temperature is a preferable example. Such fat and oil is preferably a vegetable oil, more preferably coconut oil, soybean oil, canola oil, cottonseed oil, corn oil, sunflower oil, and safflower oil, and further more preferably coconut oil (ascending melting point: 25°C). From the standpoint of its
30 flavor, price, etc., coconut oil (refined) is usually used. Coconut oil is relatively easy to handle in a manufacturing setting because coconut oil is liquefied by slight heating. Preferable are oils that are refined such that the smell and color thereof do not affect the final beverage products (e.g.,
35 refined coconut oil).

[0025]

In step (a), the amount of the powdery edible processed plant product to be mixed with and dispersed in fat and oil is selected from the range of 1 to 200 parts by weight, preferably 10 to 150 parts by weight, and more preferably 50 to 100 parts by weight, per 100 parts of the fat and oil (on a dry weight basis).

[0026]

From the standpoint of the advantageous effects of the present invention, an actually produced, final beverage product comprises the powdery edible processed plant product (on a dry weight basis) in an amount selected from the range of 0.1 to 20 wt%, preferably 0.3 to 10 wt%, and more preferably 0.5 to 5 wt% based on the amount of the beverage taken as 100 wt%. The final beverage product comprises the fat and oil in an amount selected from the range of 0.1 to 50 wt%, preferably 0.5 to 10 wt%, and more preferably 1 to 5 wt% based on the amount of the beverage taken as 100 wt%. Thus, it is preferable to suitably adjust the above-described amount of the powdery edible processed plant product relative to the amount of fat and oil so that the amounts of the powdery edible processed plant product and fat and oil in the final beverage product fall within the above-described numerical ranges.

[0027]

The method for dispersing a powdery edible processed plant product in fat and oil is not particularly limited. For example, a powdery edible processed plant product, preferably a dry powder of an edible processed plant product, *per se*, may be added to fat and oil, and mixed with stirring in accordance with a conventional technique.

[0028]

The dispersion step is preferably in the absence of water other than the water contained in the fat and oil and the powdery edible processed plant product used as starting materials. Specifically, it is preferable that water is not additionally added (external addition) in the dispersion step. In this manner,

an edible plant-derived component, such as a greenish yellow natural pigment, can be efficiently eluted, dissolved, and dispersed in the fat and oil.

[0029]

5 This dispersion step is basically a step of dispersing only a powdery edible processed plant product in fat and oil *per se*, and it is not particularly necessary to add an additive such as a stabilizer and an emulsifier in this step. Specifically, it is preferable not to use an additive such as a stabilizer and an
10 emulsifier in the dispersion step.

[0030]

As used herein, the term "stabilizer" refers to a food additive used for improving the dispersion of granules, an insoluble solid material, or the like in foods and drinks.

15 Examples of stabilizers include, but are not limited to, seaweed polysaccharides (e.g., carrageenan, sodium alginate, and alginic acid propylene glycol ester), seed polysaccharides (e.g., guar gum and tamarind seed gum), resin polysaccharides (e.g., gum arabic, gum tragacanth, and gum karaya), pericarp polysaccharides
20 (e.g., pectin), fermented polysaccharides (e.g., xanthan gum, gellan gum, curdlan, and pullulan), cellulose, and derivatives thereof (e.g., carboxymethylcellulose sodium, and methylcellulose), starch derivatives (e.g., sodium starch glycolate), and crustacean shell extracts (e.g., chitosan).

25 [0031]

As used herein, the term "emulsifier" refers to a food additive used for improving the emulsion of oil droplets (oil phase), water droplets (aqueous phase), or the like in foods and drinks. Examples of emulsifiers include, but are not limited to,
30 fatty acid esters such as glycerin fatty acid ester, sorbitan fatty acid ester, sucrose fatty acid ester, and propylene glycol fatty acid ester.

[0032]

The temperature conditions in the dispersion step are
35 not particularly limited, and are typically 5 to 60°C, preferably

10 to 40°C, and more preferably 20 to 30°C. The dispersion is carried out at a temperature of the above-stated conditions for 0.5 to 15 minutes, and preferably about 0.5 to 10 minutes, by stirring the mixture of fat and oil and a powdery edible
5 processed plant product using a stirrer, a stirring blade, and a spatula.

[0033]

After the dispersion step, the obtained fat and oil dispersion may optionally be subjected to a homogenization
10 treatment. The homogenization treatment can be carried out using a typical homogenization machine and equipment such as a homogenizer, an ultrasonic emulsification machine, a colloid mill, a line mill, a homomixer, an agihomomixer, a U-Mixer, and a Milder. It is preferable to use a high-speed homomixer, and more
15 preferably a high-pressure homogenizer (e.g., Manton-Gaulin, Microfluidizer, Nanomizer; all trade names). The pressure conditions for the use of a high-pressure homogenizer are not limited, and are typically 1 to 50 MPa, preferably 5 to 40 MPa, and more preferably 10 to 40 MPa. The rotational speed of a high-
20 speed homomixer is not limited; on a laboratory scale, for example, a T.K. Homomixer (Primix Corporation; a device for accelerating emulsification and dispersion by shearing when a substance passes between a high-speed rotating turbine blade having a diameter of 30 mm and a stator) is typically used at
25 2,000 to 10,000 rpm, preferably 3,000 to 9,000 rpm, and more preferably 5,000 to 7,000 rpm. The temperature conditions can be set typically at 10 to 80°C, preferably 30 to 70°C, and more preferably 40 to 60°C. The homogenization treatment time is, although not limited to, 1 to 30 minutes, for example.

30 [0034]

Step (b): Homogenization Step

The dispersion (fat and oil dispersion) of a powdery edible processed plant product in fat and oil prepared in step (a) is then mixed with water, which is water for preparing a
35 beverage (hereinafter referred to as "beverage preparation

water"), and the mixture is subjected to a homogenization treatment (step (b)).

[0035]

In the step of mixing the fat and oil dispersion with
5 beverage preparation water, one or more other edible components (except for a stabilizer and an emulsifier) to be added to the beverage other than the beverage preparation water may be added and mixed. The one or more other edible components to be added to a beverage, when containing water, may be added and mixed in
10 place of the beverage preparation water.

[0036]

The "one or more other edible components" are not particularly limited as long as they are not a stabilizer or an emulsifier (food additives). Examples thereof include: milk (e.g.,
15 raw milk, cow milk, special-grade cow milk, raw goat milk, pasteurized goat milk, partially skimmed milk, skim milk, and processed milk), and dairy products (e.g., cream, butter, butter oil, whey, condensed whey, condensed milk, skimmed condensed milk, sugarless condensed milk, sugarless skimmed condensed milk, sweetened condensed milk, sweetened skimmed condensed milk, whole
20 milk powder, skim milk powder, cream powder, whey powder, buttermilk powder, sweetened milk powder, modified milk powder, fermented milk, *Lactobacillus* beverages, and milk beverages); eggs and processed products of eggs; alcohols; sweeteners such as
25 saccharides and synthetic sweeteners; pH adjusters; starch; seasonings such as salts and acidic ingredients; coloring; extracts; micronutrients; and flavoring. These edible components are suitably added in accordance with the type of beverage actually produced.

30 [0037]

For example, in the production of a milk beverage (a beverage containing, as a primary ingredient, raw milk, cow milk, or a dairy product, with the milk solid content (nonfat milk solid and milk fat) being 3.0% or more), the above-described milk
35 or dairy products can be added in addition to the beverage

preparation water (or in place of the beverage preparation water) in accordance with the type of milk beverage. In the production of an alcoholic beverage, Japanese sake, beer, distilled spirit, wine, whiskey, brandy, vodka, gin, plum liquor, or the like can
5 be added in addition to the beverage preparation water (or in place of the beverage preparation water) in accordance with the type of alcoholic beverage.

[0038]

From the standpoint of the advantageous effects of the
10 present invention, the amounts of beverage preparation water and other edible components to be contained in an actually produced final beverage product may be suitably adjusted so that the powdery edible processed plant product is contained in an amount of 0.1 to 20 wt%, preferably 0.3 to 10 wt%, and more preferably
15 0.5 to 5 wt% on a dry weight basis, and the fat and oil is contained in an amount of 0.1 to 50 wt%, preferably 0.5 to 10 wt%, and more preferably 1 to 5 wt%, based on the amount of the beverage taken as 100 wt% as described above. As long as the amounts of the powdery edible processed plant product and the fat
20 and oil fall within these ranges, the amounts of beverage preparation water and other edible components can be suitably adjusted depending on the desired palatability of the beverage.

[0039]

The homogenization treatment to the mixture produced by
25 the above-described method is carried out by a typical machine and equipment for homogenization, such as a homogenizer, an ultrasonic emulsification machine, a colloid mill, a line mill, a homomixer, an agihomomixer, a U-Mixer, and a Milder, preferably a high-speed homomixer, and more preferably a high-pressure
30 homogenizer (e.g., Manton-Gaulin, Microfluidizer, and Nanomizer; all trade names).

[0040]

The pressure conditions for use of a high-pressure homogenizer are not limited. The pressure is typically within the
35 range of 1 to 50 MPa, preferably 5 to 40 MPa, and more preferably

10 to 40 MPa. The rotational speed for use of a high-speed homomixer is not limited; on a laboratory scale, for example, a T.K. Homomixer (Primix Corporation; a device for accelerating emulsification and dispersion by shearing when a substance passes
5 between a high-speed rotating turbine blade having a diameter of 30 mm and a stator) is typically used at 2,000 to 10,000 rpm, preferably 3,000 to 9,000 rpm, and more preferably 5,000 to 7,000 rpm. The temperature conditions can be set typically at 10 to 80°C, preferably 30 to 70°C, and more preferably 40 to 60°C. The
10 homogenization treatment time is, although not limited to, 5 to 30 minutes, for example.

[0041]

In accordance with the above-described method, the beverage according to the present invention can be produced and
15 obtained. When the beverage is produced as a commercial product for distribution in the market, it is preferable to pack the beverage prepared (produced) by the above-described method into containers, such as cans, bottles, cartons, and retort pouches, seal the containers, and then subject the containers to a
20 sterilization treatment. In this manner, beverages packed in containers (packaged beverages) can be produced and obtained.

[0042]

The sterilization treatment to the mixture and beverage produced by the above-described method is not particularly
25 limited. Depending on the type of actually produced beverage, it is possible to use a typical sterilization treatment (e.g., ultra-high temperature plate sterilization (UHT), high-temperature-short-time tube sterilization (HTST), retort sterilization, and autoclave sterilization).

30 [0043]

Despite the presence of an insoluble solid material (i.e., a powdery edible processed plant product), the beverage produced by the above-described method shows improved dispersion stability, and significantly suppressed sedimentation phenomena,
35 which occur over time, as compared to a beverage produced without

conducting the step of dispersing the powdery edible processed plant product *per se* in fat and oil (control beverage).

[0044]

The evaluation of the "dispersion stability" can be
5 conducted as follows: both of a beverage produced by the above-described method of the present invention (present beverage) and a control beverage are allowed to stand at temperatures from cool to room temperature after being optionally sterilized, and the sediments of insoluble solid materials (generation of sediment)
10 generated when the beverages are allowed to stand are observed over time. Specifically, the dispersion stability of the present beverage is considered to have been improved when the amount of the generated sediment is less than that of the control beverage, or the generation rate of sediment is slower than that of the
15 control beverage.

[0045]

Further, even though an insoluble solid material such as a powdery edible processed plant product settles out and accumulates on the bottom of the container, the beverage produced
20 by the above-described method shows significantly improved redispersibility so that the initial dispersion state of the powdery edible processed plant product is easily recovered by light shaking, as compared to the control beverage.

[0046]

25 The evaluation of the "redispersibility" can be conducted as follows: both of a beverage produced by the above-described method of the present invention (present beverage) and a control beverage are allowed to stand at temperatures ranging from cool to room temperature after being optionally sterilized,
30 and the beverages are compared in terms of ease of dispersion of the sediment of the insoluble solid material generated when the beverages are allowed to stand. For example, the redispersibility of the present beverage is considered to have been improved when the insoluble solid material settled on the bottom of a container
35 can be better redispersed throughout the present beverage than in

the control beverage, or the rate of redispersibility is faster than in the control beverage, after both of the beverages are shaken under the same conditions.

[0047]

5 (II) Beverage Containing Powdery Edible Processed Plant Product

The beverage according to the present invention contains at least a powdery edible processed plant product, fat and oil, and water, wherein (i) the dispersion stability of the powdery edible processed plant product is improved; or (ii) the
10 redispersibility of the powdery edible processed plant product is improved, as compared to a beverage prepared without conducting the step of mixing a powdery edible processed plant product with fat and oil to form a dispersion (control beverage).

[0048]

15 The beverage of the present invention having the above-described features can be produced by the production method described in section (I), more specifically the production method comprising at least steps (a) and (b). The method may further comprise a homogenization step between step (a) and step (b). The
20 types of beverage components of the present invention (i.e., the powdery edible processed plant product and fat and oil), the amounts of the beverage components, steps (a) and (b), and the homogenization step between steps (a) and (b) are as described in section (I), and all of which are also applied herein.

25 [0049]

As described above, it is sufficient as long as the beverage of the present invention contains at least a powdery edible processed plant product, fat and oil, and water, and has the above-described technical features (i) and (ii). As long as
30 the beverage meets these requirements, the production method is not limited to the above-described production method.

[0050]

Preferably, while the beverage according to the present invention contains at least a powdery edible processed plant
35 product, fat and oil, and water, and has the above-described

technical features (i) and (ii), the beverage also has the feature (iii) that the color fading or color change of the powdery edible processed plant product in the beverage is suppressed, as compared to the control beverage.

5 [0051]

The evaluation of the suppression of the color fading or color change can be conducted as follows: both of a beverage produced by the above-described method of the present invention (present beverage) and a control beverage are sterilized and/or
10 allowed to stand at temperatures ranging from cool to warm temperature, and the thus-occurring color change of these beverages is observed over time with reference to the color hue of the beverages observed immediately after the preparation. For example, the color fading or color change of the present beverage
15 is considered to have been suppressed when the color hue change is less than that of the control beverage.

[0052]

(III) Method for Improving Dispersion Stability or Redispersibility of Powdery Edible Processed Plant Product in
20 Beverage

The present invention also relates to a method for improving the dispersion stability or redispersibility of a powdery edible processed plant product in a beverage.

[0053]

25 The method can be carried out by mixing a prepared dispersion of a powdery edible processed plant product in fat and oil with water, and homogenizing the mixture in the production process of a powdery edible processed plant product-containing beverage.

30 [0054]

The types of the powdery edible processed plant product and fat and oil used in the method, and the amounts thereof are as described in section (I), and all of which are also applied herein.

35 [0055]

The method of the present invention can be carried out using a prepared dispersion of a powdery edible processed plant product in fat and oil as a starting material, mixing it with water, and homogenizing the mixture in the production of a powdery edible processed plant product-containing beverage; or the method can be carried out by conducting a step of dispersing a powdery edible processed plant product in fat and oil (step (a)), and a step of mixing the dispersion with water and homogenizing the mixture (step (b)). These steps employed in the method (a step of dispersing a powdery edible processed plant product in fat and oil (step (a)), and a step of mixing the dispersion with water and homogenizing the mixture (step (b))) are also as described in section (I) above, and all of which are also applied herein.

[0056]

The above-described method can improve the dispersion stability or redispersibility of a powdery edible processed plant product in a beverage. More specifically, the method according to the present invention can improve (i) the dispersion stability of a powdery edible processed plant product, or (ii) the redispersibility of a powdery edible processed plant product in a beverage containing at least the powdery edible processed plant product, fat and oil, and water, as compared to a beverage prepared without conducting the step of mixing a powdery edible processed plant product with fat and oil to form a dispersion (control beverage).

[0057]

Furthermore, while the method according to the present invention has the above-described technical feature (i) or (ii), the method also has the technical feature (iii) that the color fading or color change of a powdery edible processed plant product contained in a beverage is suppressed, as compared to a control beverage.

[0058]

Herein, the meaning and evaluation of the "dispersion

stability," "redispersibility," and "suppression of the color fading or color change" are as described in section (II) above, and all of which are also applied herein.

5 Examples

[0059]

The following Experimental Examples and Examples describe the present invention. However, the present invention is not limited to these Examples.

10 [0060]

Experimental Example 1

(I) Preparation of Milk-Containing Beverage

(1) The components listed in Table 1 were mixed in the indicated amounts in accordance with the following procedure to prepare fat
15 and oil dispersions 1-1 to 1-3. As a green tea powder (dry product), Tsujiri Matcha (Tsujiriichihonten Inc., count median diameter: 24.69 μm) was used.

[0061]

Table 1

Components	Amounts (Compositional Ratio)
(a) Skim Milk Powder	10.4 g (2.6%)
(b) Refined Coconut Oil	4.2 g (1.05%)
(c) Green Tea Powder	3.0 g (0.75%)
(d) Ion-Exchanged Water	382.4 g (95.6%)
Total	400.0 g (100.0%)

20 [0062]

Fat and Oil Dispersion 1-1: (a) Skim milk powder, (b) refined coconut oil, and (d) ion-exchanged water were mixed, and (c) green tea powder was added thereto. The green tea powder was well dispersed using a medicine spoon, thereby preparing fat and oil
25 dispersion 1-1 (preparation carried out at 25°C).

Fat and Oil Dispersion 1-2: (c) Green tea powder was mixed with and dispersed in (b) refined coconut oil, and then the dispersion was mixed with (a) skim milk powder and (d) ion-exchanged water, thereby preparing fat and oil dispersion 1-2.

30 Fat and Oil Dispersion 1-3: (c) Green tea powder was mixed with and dispersed in (b) refined coconut oil, and then the dispersion

was further homogenized at 50°C at 35 MPa using a homogenizer (Niro Soavi). Subsequently, the homogenized dispersion was mixed with (a) skim milk powder and (d) ion-exchanged water, thereby preparing fat and oil dispersion 1-3.

5 [0063]

(2) The obtained fat and oil dispersions 1-1 to 1-3 were individually heated to 60°C, and homogenized at 60°C at 7,000 rpm for 60 seconds using a homomixer (Primix Corporation).

Subsequently, the fat and oil dispersions 1-1 to 1-3 were
10 homogenized at 50°C at 35 MPa using a homogenizer (Niro Soavi).

[0064]

(3) The homogenized products 1-1 to 1-3 obtained above were packed in respective heat-resistant bottles (80 ml) and sealed, followed by heat sterilization at 110°C for 5 minutes, thereby
15 preparing powdered green tea-containing milk beverages 1-1 to 1-3.

[0065]

(II) Evaluation of Dispersion Stability (Suppression of Sedimentation) and Redispersibility, and Evaluation of Color Fading

20 Powdered green tea-containing milk beverages 1-1 to 1-3 prepared above were evaluated for color hue, and allowed to stand at room temperature for 3 days. Subsequently, visual observation was performed to evaluate the color hue of each beverage and the presence or absence of sediment settled on the bottom of each
25 beverage bottle. Thereafter, the heat-resistant bottles containing the powdered green tea-containing milk beverages were inverted once (after being inverted once, the bottles were returned to their original position), and evaluated for redispersibility of the sediment. These evaluations were
30 conducted in accordance with the following criteria (the same applies to Experimental Examples 2 to 4).

[0066]

Criteria

*1: Presence or Absence of Sediment

35 "-": none, "±": present in a small amount, "+": present, "++":

present in a significant amount

*2: Color Hue

"◎": no change to brown color, "O"; turned slightly brownish,

5 "Δ": turned brownish, "×": turned significantly brownish

*3: Redispersibility

"A": Excellent (the initial dispersion state is almost fully recovered, "B": slightly poor (sediment remains on the bottom of
10 a bottle), "C": poor (almost no dispersion occurs)

[0067]

Table 2 shows the results.

[0068]

Table 2

		Milk Beverage 1-1	Milk Beverage 1-2	Milk Beverage 1-3
Before heat-sterilization at 110°C for 5 min	Presence or Absence of Sediment * ¹	-	-	-
	Color Hue * ²	◎	◎	◎
After heat-sterilization at 110°C for 5 min	Presence or Absence of Sediment * ¹	-	-	-
	Color Hue * ²	Δ	O	O
Allowed to stand at room temperature for 3 days	Presence or Absence of Sediment * ¹	++	+	+
	Color Hue * ²	×	O	O
After being allowed to stand at room temperature for 3 days, the bottles were inverted once	Redispersibility * ³	B	A	A

15 [0069]

As shown in Table 2, powdered green tea-containing milk
beverages 1-2 and 1-3 prepared using a prepared fat and oil
dispersion obtained by mixing powdered green tea with fat and oil
(refined coconut oil) to form a dispersion in the production of
20 the powdered green tea-containing milk beverages showed improved
dispersion stability of the powdered green tea and significantly
suppressed sedimentation of the green tea powder, which occurs in
storage after heat sterilization, as compared to powdered green
tea-containing milk beverage 1-1 produced without preparing the
25 fat and oil dispersion. The results also confirmed that powdered
green tea-containing milk beverages 1-2 and 1-3 showed
significantly suppressed degradation of color hue (color fading)

of the green tea powder, which is caused by heat sterilization, as compared to powdered green tea-containing milk beverage 1-1.

[0070]

A comparison between the cases where the fat and oil dispersion was homogenized (powdered green tea-containing milk beverage 1-3) and not homogenized (powdered green tea-containing milk beverage 1-2) revealed no significant difference in dispersion stability (presence or absence of sediment), degradation of color hue (color fading), and redispersibility.

[0071]

Experimental Example 2

The same procedures for preparing powdered green tea-containing milk beverages 1-1 and 1-2 in Experimental Example 1 were repeated using "Jinen no Shiro" (Aiya Co., Ltd., count median diameter: 12.23 μ m) in place of the Tsujiri Matcha (Tsujiriichihonten Inc.) as a green tea powder, thereby preparing powdered green tea-containing milk beverages 2-1 and 2-2. Powdered green tea-containing milk beverages 2-1 and 2-2 were evaluated for dispersion stability (presence or absence of sediment), degradation of color hue (color fading), and redispersibility in accordance with the method and criteria described in section (II) of Experimental Example 1.

[0072]

Table 3 shows the results.

[0073]

Table 3

		Milk Beverage 2-1	Milk Beverage 2-2
Before heat-sterilization at 110°C for 5 min	Presence or Absence of Sediment * ¹	-	-
	Color Hue * ²	◎	◎
After heat-sterilization at 110°C for 5 min	Presence or Absence of Sediment * ¹	+	±
	Color Hue * ²	×	△
Allowed to stand at room temperature for 3 days	Presence or Absence of Sediment * ¹	++	+
	Color Hue * ²	×	△
After being allowed to stand at room temperature for 3 days, the bottles were inverted once	Redispersibility * ³	C	A

[0074]

As shown in Table 3, powdered green tea-containing milk beverage 2-2 prepared using a prepared fat and oil dispersion obtained by mixing green tea powder with fat and oil (refined coconut oil) to form a dispersion in the production of the powdered green tea-containing milk beverage showed improved dispersion stability of the powdered green tea and significantly suppressed sedimentation of the powdered green tea, which occurs in storage after heat sterilization, as compared to powdered green tea-containing milk beverage 2-1 produced without preparing the fat and oil dispersion. The results also confirmed that powdered green tea-containing milk beverage 2-2 showed significantly suppressed degradation of color hue (color fading) of the green tea powder, which is caused by heat sterilization, as compared to powdered green tea-containing milk beverage 2-1.

[0075]

Experimental Example 3

(I) Preparation of Powdered Green Tea-Containing Beverage

(1) The components listed in Table 4 were mixed in the indicated amounts in accordance with the following procedure, thereby preparing fat and oil dispersions 3-1 and 3-2. As a green tea powder, Jinen no Shiro (Aiya Co., Ltd., count median diameter: 12.23 μm) was used.

[0076]

Table 4

Components	Amounts (Compositional Ratio)
Refined Coconut Oil	4.2 g (1.05%)
Green Tea Powder	3.0 g (0.75%)
Emulsifier P-1670	0.12 g (0.12%)
Emulsifier 681SPV	0.12 g (0.12%)
Ion-Exchanged Water	392.56 g (98.14%)
Total	400.0 g (100.0%)

[0077]

Fat and Oil Dispersion 3-1: Refined coconut oil, emulsifier P-1670 (Mitsubishi-Kagaku Foods Corporation; sugar ester), emulsifier 681SPV (Taiyo Kagaku Co., Ltd.), and ion-exchanged water were mixed, and green tea powder was added thereto. The green tea powder was well dispersed using a medicine spoon,

thereby preparing fat and oil dispersion 3-1.

Fat and Oil Dispersion 3-2: Green tea powder was mixed with and dispersed in refined coconut oil using a medicine spoon.

Subsequently, the dispersion was mixed with emulsifiers P-1670

5 and 681SPV and ion-exchanged water, thereby preparing fat and oil dispersion 3-2.

[0078]

(2) The obtained fat and oil dispersions 3-1 and 3-2 were individually heated to 60°C, and homogenized at 60°C at 7,000 rpm
10 for 60 seconds using a homomixer (Primix Corporation).

[0079]

(3) The homogenized products 3-1 and 3-2 were packed in respective heat-resistant bottles (80 ml) and sealed, followed by heat sterilization at 110°C for 5 minutes, thereby preparing
15 powdered green tea-containing milk beverages 3-1 and 3-2.

[0080]

(II) Evaluation of Dispersion Stability (Suppression of Sedimentation) and Redispersibility, and Evaluation of Color Fading

20 Powdered green tea-containing milk beverages 3-1 and 3-2 prepared above were allowed to stand at room temperature for 3 days, and then visually evaluated for the presence or absence of sediment settled on the bottom of the bottles. Subsequently, the heat-resistant bottles containing the powdered green tea-
25 containing beverages were inverted once (after being inverted once, the bottles were returned to their original position), and the evaluation for redispersibility of the sediment was conducted. These evaluations were conducted in accordance with the criteria described in Experimental Example 1.

30 [0081]

Table 5 shows the results.

[0082]

Table 5

		Beverage 3-1	Beverage 3-2
Before heat-sterilization at 110°C for 5 min	Presence or Absence of Sediment * ¹	-	-
After heat-sterilization at 110°C for 5 min	Presence or Absence of Sediment * ¹	-	-
Allowed to stand at room temperature for 3 days	Presence or Absence of Sediment * ¹	++	+
After being allowed to stand at room temperature for 3 days, the bottles were inverted once	Redispersibility * ³	C	A

[0083]

As shown in Table 5, powdered green tea-containing beverage 3-2 produced using a prepared fat and oil dispersion obtained by mixing green tea powder with fat and oil (refined coconut oil) to form a dispersion in the production of the powdered green tea-containing beverage showed improved dispersion stability of the green tea powder and significantly suppressed sedimentation of the green tea powder, which occurs in storage after heat sterilization, as compared to powdered green tea-containing milk beverage 3-1 produced without preparing the fat and oil dispersion. The results also confirmed that powdered green tea-containing milk beverage 3-2 showed improved redispersibility so that the sediment of the green tea powder was easily dispersed by lightly shaking the bottle, as compared to powdered green tea-containing milk beverage 3-1.

[0084]

Experimental Example 4

The same procedures for preparing powdered green tea-containing milk beverages 1-1 and 1-2 in Experimental Example 1 were repeated using a kale powder (Kodama Foods Co., Ltd., count median diameter: 124 μm) and a micro powder of barley (young grass) (Kodama Foods Co., Ltd., count median diameter: 40 μm) in place of the Tsujiri Matcha (Tsujiriichihonten Inc.), thereby preparing kale powder-containing beverages 4-1 and 4-2, and barley (young grass) powder-containing beverages 5-1 and 5-2. These powder-containing beverages 4-1, 4-2, 5-1, and 5-2 were

evaluated for dispersion stability (presence or absence of sediment), degradation of color hue (color fading), and redispersibility in the manner described in section (II) of Experimental Example 1 (the storage conditions were changed from 3 days at room temperature to 4 days at cool temperature), in accordance with the criteria described in section (II) of Experimental Example 1.

[0085]

Table 6 shows the results.

[0086]

Table 6

		Beverage 4-1	Beverage 4-2	Beverage 5-1	Beverage 5-2
Before heat-sterilization at 110°C for 5 min	Presence or Absence of Sediment * ¹	-	-	-	-
	Color Hue * ²	◎	◎	◎	◎
After heat-sterilization at 110°C for 5 min	Presence or Absence of Sediment * ¹	+	-	+	±
	Color Hue * ²	O	O	O	O
Allowed to stand at cool temperature for 4 days	Presence or Absence of Sediment * ¹	++	±	++	+
	Color Hue * ²	O	O	O	O
After being allowed to stand at cool temperature for 4 days, the bottles were inverted once	Redispersibility * ³	C	A	B	A

[0087]

As shown in Table 6, kale powder-containing beverage 4-2 and barley (young grass)-powder-containing beverage 5-2 produced using a prepared fat and oil dispersion obtained by mixing a kale powder or a barley (young grass) powder with fat and oil (refined coconut oil) to form a dispersion in the production of the powder-containing beverages showed improved dispersion stability of each of the kale powder and the barley (young grass) powder and significantly suppressed sedimentation of each of the insoluble solid materials, which occurs in storage after heat sterilization, as compared to beverages 4-1 and 5-1 produced without preparing the fat and oil dispersion. The results also confirmed that beverages 4-2 and 5-2 showed improved redispersibility so that the sediment of each of the kale powder and the barley young grass powder was easily dispersed by lightly

shaking the bottle, as compared to beverages 4-1 and 5-1.

[0088]

Experimental Example 5

The components listed in Table 7 were mixed in the order described in the following sections (1) and (2), and the two obtained samples were evaluated for their properties. For powdered green tea, "Tsuji Matcha" (Tsujiichihonten Inc., count median diameter: 24.69 μm) was used.

[0089]

Table 7

Components	Amounts (Compositional Ratio)
Refined Coconut Oil	49.25 g (49.25%)
Green Tea Powder	0.75 g (0.75%)
Ion-Exchanged Water	50.00 g (50.00%)
Total	100.0 g (100.0%)

[0090]

(1) Green tea powder was added to and mixed with ion-exchanged water, and then refined coconut oil was added thereto. The powder was well mixed and dispersed using a medicine spoon, thereby preparing sample (1).

[0091]

(2) Green tea powder was added to refined coconut oil, and well stirred to make a uniform paste using a medicine spoon. Subsequently, ion-exchanged water was added to the paste, and the mixture was well mixed using a medicine spoon, thereby preparing sample (2).

[0092]

Prepared samples (1) and (2) were allowed to stand at room temperature (25°C) for 20 minutes, and the properties of the samples were visually confirmed, followed by centrifugation (1,000 rpm, 5 minutes, 25°C).

[0093]

Fig. 1(A) shows the state of samples (1) and (2) observed after the samples were allowed to stand at room temperature (25°C) for 20 minutes. Fig. 1(B) shows the state of samples (1) and (2) observed after the samples were further placed into respective centrifuge tubes, and centrifuged. Both

Figs. 1(A) and 1(B) show the state of sample (1) on the left, and show the state of sample (2) on the right. At this stage, both samples (1) and (2) were observed as emulsions having a large particle diameter.

5 [0094]

As shown in Fig. 1, when green tea powder was directly mixed with coconut oil, a significant amount of chlorophyll, which is a natural coloring element contained in green tea powder, blended into the oil phase (upper layer), whereas when green tea
10 powder was first dissolved in water and then mixed with coconut oil, chlorophyll did not blend well into the oil phase (upper layer). This indicates that compositions (mixtures) having different properties can be obtained, depending on the order of addition of green tea powder (powdery edible processed plant
15 product), fat and oil, and water.

CLAIMS

1. A method for producing a beverage containing a powdery edible processed plant product, the method comprising the
5 steps of:

(a) mixing a powdery edible processed plant product with fat and oil to thereby form a dispersion; and

(b) mixing the dispersion of the powdery edible processed plant product in the fat and oil with water and
10 homogenizing the mixture.

2. The method according to Claim 1, further comprising a homogenization step between step (a) and step (b).

15 3. The method according to Claim 1 or 2, wherein the water used in step (b) contains milk or one or more dairy components.

4. The method according to any one of Claims 1 to 3,
20 the method not comprising adding a stabilizer and/or an emulsifier.

5. The method according to any one of Claims 1 to 4, wherein the powdery edible processed plant product is a dry
25 powder of at least one type of plant selected from the group consisting of tea, vegetables, fruits, grain, and beans.

6. The method according to any one of Claims 1 to 5, wherein the dispersion obtained in step (a) does not contain
30 water other than water from the fat and oil and the edible processed plant product used as starting materials.

7. A beverage, which is obtained by the method according to any one of Claims 1 to 6, the beverage containing at
35 least a powdery edible processed plant product, fat and oil, and

water, the beverage showing at least improved dispersion stability of the powdery edible processed plant product or improved redispersibility of the powdery edible processed plant product, as compared to a beverage prepared without conducting
5 the step of mixing a powdery edible processed plant product with fat and oil to form a dispersion.

8. The beverage according to Claim 7, which shows suppressed color fading of the powdery edible processed plant
10 product.

9. A method for improving dispersion stability or redispersibility of a powdery edible processed plant product in a beverage, the method comprising, in a step of producing the
15 beverage containing the powdery edible processed plant product, the step of mixing a prepared dispersion of the powdery edible processed plant product in fat and oil with water and homogenizing the mixture.

20 10. The method according to Claim 9, wherein the water contains milk or one or more dairy components.

11. The method according to Claim 9 or 10, the method not comprising adding a stabilizer and/or an emulsifier.
25

12. The method according to any one of Claims 9 to 11, wherein the powdery edible processed plant product is a dry powder of at least one type of plant selected from the group consisting of tea, vegetables, fruits, grain, and beans.
30

13. The method according to any one of Claims 9 to 12, wherein the dispersion of the powdery edible processed plant product in the fat and oil does not contain water other than water from the fat and oil and the edible processed plant product.
35

14. The method according to any one of Claims 9 to 13,
which improves dispersion stability or redispersibility of the
powdery edible processed plant product in the beverage, while
suppressing color fading of the powdery edible processed plant
5 product in the beverage.