

[DESCRIPTION]

[Title of Invention] AQUEOUS LIQUID BEVERAGE

[Technical Field]

The present invention relates to an aqueous liquid
5 beverage, and is utilizable in the fields of drugs, quasi
drugs, foods, and so forth.

[Background Art]

Leading to metabolic syndrome, obesity is a serious
social problem. Effective means for preventing obesity
10 includes dieting: restricting amounts of meals taken.
However, dieting cannot be continued for a long term due
to hunger caused by the dieting per se in real circumstances.
Hence, in order to eliminate hunger, a hunger reducing agent
containing a flavor or a flavor compound as the main
15 component (see PTL 1), a cereal food (see PTL 2), an edible
phosphoprotein and a metal carbonate (see PTL 3), and the
like have been provided.

As one of methods for alleviating such hunger, a method
has been reported, which uses agar, for increasing the gel
20 strength of the agar which is immersed in a gastric juice
for a certain period (see PTL 4). Nevertheless, this method
is hardly said to be highly practical because such hard
gel has to be chewed and swallowed. Meanwhile, there has
also been a report on a method which uses a gastric raft
25 composition containing a gelling agent (see PTL 5); however,
the strength of the gel is so low that hunger cannot be

suppressed for a long period.

[Citation List]

[Patent Literatures]

[PTL 1] Japanese Unexamined Patent Application
Publication No. 2008-7427

[PTL 2] Japanese Unexamined Patent Application
Publication No. 2007-53929

[PTL 3] Japanese Unexamined Patent Application
Publication No. 2010-94085

[PTL 4] Japanese Unexamined Patent Application
Publication No. 2008-110923

[PTL 5] International Application Japanese-Phase
Publication No. 2009-530254

[Summary of Invention]

[Technical Problem]

An object of the present invention is to provide an aqueous liquid beverage which is a normal aqueous liquid beverage before drunken, but which turns into a gel by reaction with gastric acid in the stomach after drunken, so that the aqueous liquid beverage has a characteristic of remaining long in the stomach.

[Solution to Problem]

The present inventor has conducted earnest study to achieve the above object. As a result, the inventor has found that an aqueous liquid beverage in which a LM pectin is blended with a polyoxyethylene-based nonionic

surfactant turns into a gel by reaction with an artificial gastric juice (Japanese Pharmacopoeia first fluid), and thus a gel having a high strength is obtained.

Aspects of the present invention obtained from such a finding are as follows.

(1) An aqueous liquid beverage characterized by comprising a LM pectin and a polyoxyethylene-based nonionic surfactant.

(2) The aqueous liquid beverage according to (1), wherein an amount of the polyoxyethylene-based nonionic surfactant blended is 0.005 parts by mass or more relative to 1 part by mass of the LM pectin.

(3) The aqueous liquid beverage according to any one of (1) and (2), wherein the polyoxyethylene-based nonionic surfactant is polyoxyethylene hydrogenated castor oil.

(4) The aqueous liquid beverage according to any one of (1) to (3), which has a pH of 3.5 to 7.0.

[Advantageous Effect of Invention]

The present invention makes it possible to provide an aqueous liquid beverage which turns into a gel by reaction with gastric acid, and which is presumably capable of maintaining a hunger-eliminated state for a long period because the gel strength is high.

[Description of Embodiments]

The term "pectin" refers to a water-soluble polysaccharide mainly containing α -1,4-linked

polygalacturonic acid, and the compound is extracted from apples and Citreae. The pectin of the present invention may be derived from either apples or Citreae, but has to be a "LM pectin": the ratio of galacturonic acid in the form of methyl ester is less than 50% (galacturonic acid is a constituent sugar of pectins and present in the free acid form or methyl ester form). Incidentally, a pectin with the methyl ester ratio of 50% or more is referred to as a HM pectin, and is not suitable in the present invention because unless soluble solid components account for 55% or more of all the components in an acidic range, such pectin does not turn into a gel.

An amount of the LM pectin blended in the aqueous liquid beverage is 0.01 to 10% by mass, more preferably 0.1 to 3.5% by mass from the viewpoints of administration easiness and the gel strength in the stomach.

The term "polyoxyethylene-based nonionic surfactant" includes polyoxyethylene hydrogenated castor oil, polyoxyethylene sorbitan fatty acid esters, polyethylene glycol fatty acid esters, and polyoxyethylene glycerin fatty acid esters.

An amount of the polyoxyethylene-based nonionic surfactant blended is 0.005 to 50 parts by mass, preferably 0.01 to 50 parts by mass, relative to 1 part by mass of the LM pectin. This blending ratio makes it possible to provide an aqueous liquid beverage which turns into a gel

by reaction with gastric acid, and which is capable of sustaining a hunger-eliminated state for a long period because the gel strength is high.

5 The pH of aqueous liquid beverage of the present invention is preferably 3.5 to 7.0 because the LM pectin turns into a gel at a pH of lower than 3.5, and is more preferably 4.0 to 7.0 from the viewpoint that the aqueous liquid beverage is easily produced.

10 In order to keep the pH of the aqueous liquid beverage of the present invention within the above-described range, a pH modifier such as an organic acid may be blended as necessary.

15 Moreover, as other ingredients, a vitamin, a mineral, an amino acid and a salt thereof, a crude drug, a crude drug extract, caffeine, royal jelly, a dextrin, or the like may be blended as appropriate, as long as the effect of the present invention is not impaired. Furthermore, as necessary, an additive such as an antioxidant, a colorant, a flavor, a taste making agent, a preservative, or a
20 sweetener may be blended as appropriate, as long as the effect of the present invention is not impaired.

25 The aqueous liquid beverage of the present invention can be prepared according to a conventional method, and the method is not particularly limited. For example, each component is weighed and dissolved in an appropriate amount of purified water. Then, the pH thereof is adjusted, and

further purified water is added thereto to adjust the volume, as necessary, followed by filtration or sterilization, so that the aqueous liquid beverage of the present invention can be prepared.

5 The aqueous liquid beverage of the present invention can be provided as soft drinks and functional drinks, or as various beverages in the fields of drugs and quasi drugs such as health drinks and syrups, as well as in the field of foods such as tea drinks and sports drinks.

10 [Examples]

 Hereinafter, the present invention will be described in more details by illustrating Examples, Comparative Examples, and Test Example.

 (Examples and Comparative Examples)

15 Citric acid hydrate and sodium benzoate were added to purified water. Further, as a polyoxyethylene-based nonionic surfactant, polyoxyethylene hydrogenated castor oil (Examples 1 to 6), decaglycerin monooleic acid ester as a polyglycerin fatty acid ester (Comparative Example
20 2), or purified soybean lecithin as a lecithin (Comparative Example 3) was added to and dissolved in the mixture. The pH was adjusted to 3.5 (in a case where the final pH was 4.0) or 4.5 (in a case where the final pH was 4.5 or 7.0) with hydrochloric acid and sodium hydroxide. The solution
25 was heated to 80°C and a LM pectin was dissolved therein. Purified water was added to the solution to make the total

amount 100 mL. The pH was adjusted to 4.0, 4.5, or 7.0 with sodium hydroxide. Each test solution was filled into a glass bottle and sterilized, so that beverages of Examples 1 to 6 and Comparative Examples 1 to 5 illustrated in Tables 1 to 3 were obtained.

[Table 1]

Blended components		Comparative Example 1	Example 1	Comparative Example 2	Comparative Example 3
LM pectin	mg	2000	2000	2000	2000
citric acid hydrate	mg	50	50	50	50
sodium benzoate	mg	60	60	60	60
polyoxyethylene hydrogenated castor oil	mg	-	1000	-	-
polyglycerin fatty acid ester	mg	-	-	1000	-
lecithin	mg	-	-	-	1000
hydrochloric acid	mg	adequate amount	adequate amount	adequate amount	adequate amount
sodium hydroxide	mg	adequate amount	adequate amount	adequate amount	adequate amount
total amount	mL	100	100	100	100
pH		4.5	4.5	4.5	4.5

[Table 2]

Blended components		Comparative Example 4	Comparative Example 5	Example 2	Example 3
LM pectin	mg	2000	2000	2000	2000
citric acid hydrate	mg	50	50	50	50
sodium benzoate	mg	60	60	60	60
polyoxyethylene hydrogenated castor oil	mg	-	-	1000	1000
dilute hydrochloric acid	mg	adequate amount	adequate amount	adequate amount	adequate amount
aqueous solution of sodium hydroxide	mg	adequate amount	adequate amount	adequate amount	adequate amount
purified water, total	mL	100	100	100	100
pH		4.0	7.0	4.0	7.0

[Table 3]

Blended components		Comparative Example 1	Example 4	Example 5	Example 6
LM pectin	mg	2000	2000	2000	2000
citric acid hydrate	mg	50	50	50	50
sodium benzoate	mg	60	60	60	60
polyoxyethylene hydrogenated castor oil	mg	-	10	50	100
dilute hydrochloric acid	mg	adequate amount	adequate amount	adequate amount	adequate amount
aqueous solution of sodium hydroxide	mg	adequate amount	adequate amount	adequate amount	adequate amount
purified water, total	mL	100	100	100	100
pH		4.5	4.5	4.5	4.5

[Test Example 1] Gel Strength Measurement

5 The gel strength (breaking strength) was measured by the following method.

10 Into a 50-mL beaker, 12.5 mL of each sample of the beverages prepared in Examples 1 to 6 and Comparative Examples 1 to 5 was poured, and 12.5 mL of a Japanese Pharmacopoeia first fluid (first solution for Disintegration Test in Japanese Pharmacopoeia) was gently dripped along a wall surface. Note that the Japanese Pharmacopoeia first fluid is an acidic solution (pH: 1.2) equivalent to gastric juice. After the resultant was left standing at room temperature for one hour, the gel strength (breaking strength) was measured with a rheometer.

15 Apparatus used: FUDOH rheometer (manufactured by Rheotech Co., Ltd. Type: RT-2100NJ-CW)

20 Adapter used: viscoelastic, thick, and round rod $\phi 20$ mm

Test mode: breaking test

Measurement range: 20 N

Table speed: 1 cm/min

Tables 4 to 6 show average values of three measurement results.

[Table 4]

	Comparative Example 1	Example 1	Comparative Example 2	Comparative Example 3
Breaking strength (Pa) when gel was formed by dripping Japanese Pharmacopoeia first fluid	10312	18023	8046	10299

[Table 5]

	Comparative Example 4	Comparative Example 5	Example 2	Example 3
Breaking strength (Pa) when gel was formed by dripping Japanese Pharmacopoeia first fluid	6006	less than 200 (unmeasurable)	15791	9581

[Table 6]

	Comparative Example 1	Example 4	Example 5	Example 6
Breaking strength (Pa) when gel was formed by dripping Japanese Pharmacopoeia first fluid	10312	15416	12500	13607

Blending the polyoxyethylene-based nonionic surfactant (polyoxyethylene hydrogenated castor oil) as in Example 1 significantly increased the gel strength (breaking strength) in comparison with Comparative Example 1. No increase in the gel strength was observed by the polyglycerin fatty acid ester (decaglycerin monooleic acid

ester) added in Comparative Example 2 or the lecithin (purified soybean lecithin) added in Comparative Example 3 in comparison with Comparative Example 1 in which these were not added.

5 Blending the polyoxyethylene-based nonionic surfactant and making the pH 4.0 to 7.0 as in Examples 2 and 3 significantly increased the gel strength (breaking strength) in comparison with Comparative Examples 4 and 5.

10 Blending 0.005 parts by mass or more of the polyoxyethylene-based nonionic surfactant relative to 1 part by mass of the LM pectin as in Example 4 to 6 significantly increased the gel strength (breaking strength) in comparison with Comparative Example 1.

15 [Industrial Applicability]

 The present invention makes it possible to provide an aqueous liquid beverage which turns into a gel by reaction with gastric acid, and which is capable of maintaining a hunger-eliminated state for a long period because the gel strength is high. Therefore, by providing the present invention as drugs, quasi drugs, and foods which are directed to dieting for preventing obesity, these industries are expected to grow.

20

[CLAIMS]

[Claim 1]

An aqueous liquid beverage comprising a LM pectin and a polyoxyethylene-based nonionic surfactant.

5 [Claim 2]

The aqueous liquid beverage according to claim 1, wherein an amount of the polyoxyethylene-based nonionic surfactant blended is 0.005 parts by mass or more relative to 1 part by mass of the LM pectin.

10 [Claim 3]

The aqueous liquid beverage according to any one of claims 1 and 2, wherein the polyoxyethylene-based nonionic surfactant is polyoxyethylene hydrogenated castor oil.

[Claim 4]

15 The aqueous liquid beverage according to any one of claims 1 to 3, which has a pH of 3.5 to 7.0.