

MILK-CONSTITUENT-CONTAINING BEVERAGE

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention concerns coffee, tea, cocoa, and other beverages containing milk constituents, and particularly concerns stabilized milk-constituent-containing beverages in which the germination of spores of and proliferation heat-resistant spore-forming bacteria are inhibited and in which problems such as coagulation, oiling off, feathering, precipitation, neck ring, etc. of the milk constituents contained are suppressed.

The present invention applies to milk-constituent-containing beverages which are preserved and distributed in metal cans, such as aluminum cans, steel cans, etc., bottles, such as glass, ceramic, etc., and various other containers made of paper, synthetic resin, etc.

2. Description of the prior arts

Many beverages such as coffee, tea, cocoa, etc. contain milk constituents to improve flavor generally used, and taste, etc. The milk constituents used vary widely in type and amount, and include raw milk, raw cream, whole milk powder, skim milk powder, or instant creaming powder (ICP).

When stored over long periods of time, beverages containing milk constituents undergo loss of potable aptitude (marketability) due to such problems as separation, oiling off, feathering, precipitation, neck ring, etc. of the milk constituents. Also, although milk-constituent-containing beverages are usually sterilized by retorting, there are cases where the spores of heat-resistant spore-forming bacteria survive under the conditions of such treatment. In cases where milk-constituent-containing beverages are sold or stored under low-temperature storage conditions in a vending machine, etc., there is little possibility of germination of spores

of and proliferation of the surviving heat-resistant spore-forming bacteria and quality problems do not occur. However, if such beverages are placed in a heated condition, for example at 55 °C, the surviving spores of heat-resistant spore-forming bacteria can germinate and proliferate to cause the beverage contents to deteriorate and the beverage to thus lose potable aptitude (marketability).

The combined use of a polyglycerin monoesters of fatty acids, comprising lauric acid and myristic acid, and mono-and diglycerides of fatty acids (laid-open Japanese patent publication No. Hei6-121640), the combined use of sucrose esters of fatty acids and citric acid esters of mono-and diglycerides of fatty acids (laid-open Japanese patent publication No. Hei5-15349), etc. have been proposed as methods of preventing deterioration and putrefaction of the beverage contents through prevention of germination of spores of and proliferation heat-resistant spore-forming bacteria and preventing undesirable effects due to physicochemical changes at the same time. However, with the former of the above methods, not only does the lauric acid, which is a lower fatty acid, damage the flavor significantly but the antibacterial effects are also inadequate. With the latter method, since sucrose esters of fatty acids is used, the effects of preventing the germination of spores of and proliferation of heat-resistant spore-forming bacteria are inadequate and unsatisfactory.

The present inventors have previously proposed the milk-constituent-containing beverage disclosed in Japanese patent application No. Hei7-144075 (laid-open Japanese patent application No. Hei8-228676). This prior art discloses a milk-constituent-containing beverage that uses diglycerol monoesters of fatty acids as emulsifier and is characterized in that 70wt.% or more of the fatty acid composition of the diglycerol monoesters of fatty acids is taken up by the total amount of myristic acid and/or

palmitic acid. With this prior art, the germination of spores of and proliferation of heat-resistant spore-forming bacteria can be suppressed even when the beverage is stored at a high temperature over long periods.

SUMMARY OF THE INVENTION

With regard to the above mentioned prior arts, the present inventors proposed that mono-and diglycerides of fatty acids, lecithin, or other known emulsifier may be used in combination. The present inventors continued further research on this prior art. As a result, we were able to make the surprising discovery that, by selecting and making combined use of specific emulsifiers among known emulsifiers, not only can heat-resistant spore-forming bacteria growth inhibition effects be provided but the coagulation, oiling off, feathering, precipitation, and neck ring of the milk constituents can also be suppressed.

As is clear from the above, the object of the present invention is to provide a milk-constituent-containing beverage for which the germination of spores of and proliferation heat-resistant spore-forming bacteria are suppressed and for which physicochemical changes of the beverage contents are prevented over long periods, even though the beverage may be a milk-constituent-beverage for which the death rate of the spores of heat-resistant spore-forming bacteria surviving in the beverage is improved without raising the sterilization temperature conditions or a milk-constituent-containing beverage which is stored over long periods under high-temperature conditions.

In the invention, "feathering" means that feather-like coagulation arises when cream is added to coffee.

Furthermore, "oiling off" means that oil drops are joined together to become large, whereby oil is separated from the base material.

Still furthermore, "neck ring" means that white rings are formed, the

main constituents of which are fat and protein.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

The present invention shall now be described in detail.

First, the abovementioned component (A) used in the present invention shall be described.

The diglycerol monoesters of fatty acids used in the present invention can be obtained by preparing an ester mixture through esterification of diglycerol monoesters of fatty acids and fatty acids, transesterification of diglycerol monoesters of fatty acids and fatty acids and methyl esters of fatty acids or other esters, esterification of glycerol by fatty acid halides, etc. and then performing separation and purification by a method such as distillation fractionation, adsorption chromatography separation, liquid-liquid extraction separation, etc. Diglycerol monoesters of fatty acids suitable for the present purpose can usually be obtained efficiently and economically by the molecular distillation method. However, the present invention is not limited to these methods.

The constituent fatty acids of the diglycerol monoesters of fatty acids to be used in the milk-constituent-containing beverage by the present invention are mainly comprised of myristic acid and/or palmitic acid, the total amount of which comprises 70wt.% or more and preferably 90wt.% or more of the constituent fatty acids. It is unfavorable for the total amount to be less than 70wt.% since the effect of suppressing the germination of spores of and proliferation heat-resistant spore-forming bacteria will be inadequate in this case.

The monoester content of the ester mixture in the diglycerol monoesters of fatty acids used in the present invention is 70wt.% or more and preferably 80wt.% or more. It is unfavorable for the monoester content to be less than 70wt.% since the effect of suppressing the germination of

spores of and proliferation heatresistant spore-forming bacteria will be inadequate in this case.

The diglycerol monoesters of fatty acids used in the present invention may be added directly to the milk-constituent-containing beverage or may be added by mixing in the water or milk-constituent that comprises the milk-constituent-containing beverage.

The added amount of the diglycerol monoesters of fatty acids used in the present invention is 0.01 to 1.0wt.% or preferably 0.01 to 0.5wt.% to 1 part of milk-constituent-containing beverage. If the added amount is less than 0.01wt.%, the effect of suppressing the germination of spores of and proliferation heat-resistant spore-forming bacteria will be inadequate, and if the added amount is greater than 1.0wt.%, there will be an undesirable effect on the flavor.

The abovementioned component (B) used in the present invention shall be described next.

The citric acid esters of mono-and diglycerides of fatty acids, succinic acid esters of mono-and diglycerides of fatty acids, or diacetytartaric acid esters of mono-and diglycerides of fatty acids used in the present invention is a mixed ester of (a) glycerol, (b) fatty acids, and (c) citric acid, succinic acid, or diacetyl tartaric acid, and the fatty acid constituents of the ester are saturated and/or unsaturated fatty acids with 12 to 22 carbons.

The polyglycerin monoesters of fatty acids used in the present invention is an ester of polyglycerol and fatty acids, and is preferably an ester of polyglycerol with an average degree of polymerization of 3 or more and saturated and/or unsaturated fatty acids with 12 to 22 carbons. The polyglycerin monoestera of fatty acids has an HLB of 3 to 16.

The sucrose esters of fatty acids to be used in the present invention

is an esterification product of sucrose and fatty acids, and though the fatty acids thereof can be saturated and/or unsaturated fatty acids with 12 to 22 carbons, it is especially preferable for the fatty acids to be saturated fatty acids. The sucrose esters of fatty acids have an HLB of 3 to 16.

As component (B) of the present invention, one or more esters is selected from among a group comprised of citric acid esters of mono- and diglycerides of fatty acids, succinic acid esters of mono- and diglycerides of fatty acids, diacetyltartaric acid esters of mono- and diglycerides of fatty acids, polyglycerin monoester of fatty acids with an HLB of 3 to 16, and sucrose fatty acid esters with an HLB of 3 to 16. The total amount of component (B) added to the milk-constituent-containing beverage is 0.002 to 0.3wt.% and preferably 0.01 to 0.15wt.%. With an added amount of less than 0.002wt.%, the purported effects of preventing coagulation, oiling off, feathering, precipitation, etc. of milk constituents cannot be exhibited satisfactorily. An added amount of more than 0.3wt.% not only brings about an undesirable effect on the flavor and taste but is also uneconomical since the purported effects will not be improved.

By containing (A) diglycerol monoesters of fatty acids and (B) at least one emulsifier selected from a group comprised of citric acid esters of mono- and diglycerides of fatty acids, succinic acid esters of mono- and diglycerides of fatty acids, diacetyltartaric acid esters of fatty acids, polyglycerin monoesters of fatty acids with an HLB of 3 to 16, and sucrose esters of fatty acids with an HLB of 3 to 16, the milk-constituent-containing beverage of the present invention becomes a beverage with good storage properties in which the germination of spores of and proliferation heat-resistant spore-forming bacteria are suppressed, flat sour deterioration is prevented, coagulation, oiling off, feathering,

feathering, precipitation, etc. of the milk constituents will not occur, and the flavor and taste will not be damaged even when the beverage is stored under high temperature over long periods of time.

As long as the milk-constituent-containing beverage of the present invention contains the emulsifier (A) and the emulsifier (B) used in the present invention, emulsifiers besides those used in the invention may be used within quantity ranges which will not damage the effects of the invention.

EXAMPLES

The milk-constituent-containing beverage of the present invention shall now be described by way of examples and comparison examples.

Examples 1-6 and Comparison Examples 1-12

4kg of coffee bean extract, 0.8kg of granulated sugar, 4kg of raw milk were mixed to make a coffee-milk beverage. A total of 15g of the emulsifiers shown in Table 1 were then added (milk fat content: 1.5%) to this coffee-milk beverage. After preliminary emulsification, the drink was homogenized at 150kg/cm² with a piston homogenizer. Forty 250ml of the coffee-milk beverage were then dispensed into each 40 test vessels. And 1ml of a spore suspension (*B. stearothermophilus*, concentration: 1×10^4 spores/ml) was added to each test vessels. The test vessels were then heat sterilized for 1 minute at 121 °C and stored for 30 days at 55 °C. The number of aliquots among the forty test vessels which had undergone deterioration or decomposition was then counted. The results are shown in Tables 1 and 2.

At the same time, oiling off, feathering, precipitation, and neck ring were observed for the coffee-milk beverage test vessels which had not undergone deterioration due to the heat-resistant spore-forming bacteria. These results are also shown in Tables 1 and 2.

Examples 7-9 and Comparison Examples 13-20

7.6kg of coffee bean extract, 600g of granulated sugar, 960ml of raw milk, 830g of whole milk powder, and 10g of sodium bicarbonate were mixed to make a coffee-milk drink. A total of 10g of the emulsifiers shown in Table 2 were then added (milk fat content: 2.5%) to this coffee-milk drink. After preliminary emulsification, the drink was homogenized at 150kg/cm² with a piston homogenizer. Forty 250ml of the coffee-milk beverage were then dispensed and 1ml of a spore suspension (*C. thermoaceticum*, concentration: 1×10^4 spores/ml) was added to each test vessels. The test vessels were then heat sterilized for 20 minutes at 121 °C and stored for 30 days at 55 °C. The number of test vessels among the forty test vessels which had undergone deterioration or decomposition was then counted. The results are shown in Tables 3 and 4.

At the same time, oiling off, feathering, precipitation, and neck ring were observed for the coffee-milk beverage test vessels which had not undergone deterioration due to the heat-resistant spore-forming bacteria. These results are also shown in Tables 3 and 4.

Table 1

Ex.No.	Types of emulsifier (See Note 2), Figures in the() are the contents (wt.%).			Evaluation items (See Note 1)				
				A	B	C	D	E
1	A1(0.05)	B1(0.1)	—	0	⊙	⊙	○○	⊙
2	A1(0.05)	B1(0.07)	B2(0.03)	0	⊙	⊙	⊙	⊙
3	A2(0.05)	B3(0.1)	—	0	○○	⊙	○○	⊙
4	A2(0.05)	B4(0.1)	—	0	○○	○○	○○	○○
5	A3(0.05)	B5(0.1)	—	0	⊙	○	⊙	⊙
6	A4(0.05)	B1(0.1)	—	0	⊙	⊙	⊙	⊙

Note 1: Evaluation items

A = number of test vessels among the 40 test vessels that underwent deterioration, B = feathering, C = oiling off, D = precipitation, and E = neck ring, the following evaluation standards were used. When two symbols are indicated, this means that the condition is intermediate those corresponding to the two symbols. ⊙ = Unobserved, ○ = Observed slightly, □ = Observed clearly but in small quantities, △ = Observed in large quantities and X = Impossible to evaluate.

Note 2: Types of emulsifier

A1 Diglycerol monoesters of fatty acids

Constituent fatty acids: palmitic acid 99wt.%

Monoester content: 85wt.%

A2 Diglycerol monoesters of fatty acids

Constituent fatty acids: myristic acid 99wt.%

Monoester content: 80wt. %

A3 Diglycerol monoesters of fatty acids

Constituent fatty acids: myristic acid 99wt. %

Monoester content: 85wt. %

A4 Diglycerol monoesters of fatty acids

Constituent fatty acids: palmitic acid 55wt. %

myristic acid 45wt. %

Monoester content: 80wt. %

B1 Diacetyltartaric acid esters of mono-and diglycerides of fatty acids

(Used POEM W-10 made by Riken Vitamin Co.)

Constituent fatty acids: stearic acid 70wt. %, palmitic acid 30wt. %

B2 Polyglycerin monoesters of fatty acids

(Used POEM J-0381 made by Riken Vitamin Co.)

Constituent fatty acids: oleic acid 80wt. %

HLB: 12

B3 Succinic acid esters of mono-and diglycerides of fatty acids

(Used POEM B-10 made by Riken Vitamin Co.)

Constituent fatty acids: stearic acid 70wt. %, palmitic acid 30wt. %

B4 Citric acid esters of mono-and diglycerides of fatty acids

(Used POEM K-30 made by Riken Vitamin Co.)

Constituent fatty acids: stearic acid 70wt. %, palmitic acid 30wt. %

B5 Sucrose esters of fatty acids

(Used RYOTO S-1570 made by Mitsubishi Chemical Corp.)

Constituent fatty acids: stearic acid 70wt. %

HLB: 15

Table 2

Compa- rison Ex.No.	Types of emulsifier (See Note 4), Figures in the() are the contents (wt.%).			Evaluation items (See Note 3)				
				A	B	C	D	E
1	A1(0.05)	B'11(0.1)	—	0	△□	○	□○	□
2	A1(0.05)	B'12(0.1)	—	0	□	○○	□	○
3	A1(0.05)	B'13(0.1)		0	□	○	□	□
4	A'11(0.05)	B1(0.1)	—	14	◎	◎	○○	◎
5	A'12(0.05)	B'13(0.03)	B'14(0.07)	21	△□	□	□○	△
6	A'13(0.05)	B'11(0.1)	—	10	△□	○	□	△□
7	A'14(0.05)	B'15(0.1)	—	18	△	△□	△□	△
8	A'15(0.05)	B1(0.1)	—	40	X	X	X	X
9	—	B1(0.1)	B'16(0.05)	31	○○	○○	◎	○
10	—	B1(0.1)	B7(0.05)	40	X	X	X	X
11	—	B1(0.1)	B8(0.05)	37	◎	◎	○	◎
12	—	B1(0.1)	B9(0.05)	40	X	X	X	X

Note 3: Evaluation items, see Note 1 of Table 1.

Note 4: Types of emulsifier

A'11 Diglycerol monoesters of fatty acids

Constituent fatty acids: lauric acid 99wt.%

Monoester content: 90wt.%

A'12 Diglycerol monoesters of fatty acids

Constituent fatty acids: oleic acid 99wt.%

Monoester content: 90wt.%

A'13 Diglycerol monoesters of fatty acids

Constituent fatty acids: palmitic acid 55wt. %

stearic acid 45wt. %

Monoester content: 80wt. %

A'14 Diglycerol monoesters of fatty acids

Constituent fatty acids: myristic acid 99wt. %

Monoester content: 40wt. %

A'15 Diglycerol monoesters of fatty acids

Constituent fatty acids: palmitic acid 45wt. %

stearic acid 55wt. %

Monoester content: 35wt. %

B6 Citric acid esters of mono-and diglycerides of fatty acids

Constituent fatty acids: stearic acid 70wt. %, palmitic acid 30wt. %

B'11 Lecithin (Used DX lecithin made by Nisshin Seiu Co.)**B'12 Sorbitan esters of fatty acids**

(Used POEM S300B made by Riken Vitamin Co., Ltd.)

Constituent fatty acids: stearic acid 70wt. %, palmitic acid 30wt. %

B'13 Mono-and diglycerides of fatty acids

(Used EMULSEE-MS made by Riken Vitamin Co., Ltd.)

Constituent fatty acids: stearic acid 70wt. %, palmitic acid 30wt. %

B'14 Polyglycerin monoesters of fatty acids

(Used POEM J-0080 made by Riken Vitamin Co., Ltd.)

Constituent fatty acids: stearic acid 70wt. %, palmitic acid 30wt. %

B'15 Polyglycerol esters of polycondensed ricinoleic acid

(Used POEM PR-300 made by Riken Vitamin Co., Ltd.)

HLB: 0.3

B'16 Polyglycerin monoesters of fatty acids

(Used POEM J-0021 made by Riken Vitamin Co., Ltd.)

Constituent fatty acids: lauric acid 99wt. %

HLB: 15

B7 Polyglycerin monoesters of fatty acids

(Used POEM J-0041 made by Riken Vitamin Co., Ltd.)

Constituent fatty acids: myristic acid 99wt. %

HLB: 15

B8 Sucrose esters of fatty acids

(Used RYOTO P-1670 made by Mitsubishi Chemical Corp.)

Constituent fatty acids: palmitic acid 80wt. %

HLB 16

Table 3

Ex. No.	Types of emulsifier (See Note 6), Figures in the() are the contents (wt. %).			Evaluation items (See Note 5)				
				A	B	C	D	E
7	A2(0.005)	B1(0.05)	—	0	○○	◎	○○	◎
8	A2(0.005)	B1(0.035)	B2(0.015)	0	◎	◎	◎	◎
9	A1(0.05)	B4(0.05)		0	◎	◎	○○	◎

Note 5: Evaluation items, see Note 1 of Table 1.

Note 6: Types of emulsifier, see Note 2 of Table 1.

Table 4

Compa- rison Ex.No.	Types of emulsifier (See Note 4), Figures in the() are the contents (wt.%).			Evaluation items (See Note 3)				
				A	B	C	D	E
13	A1(0.05)	B'21(0.05)	—	0	□	○	□○	△□
14	A1(0.05)	B1(0.035)	B'22(0.015)	0	△□	□○	□	△
15	A'16(0.05)	B1(0.05)	—	16	○◎	◎	○◎	○◎
16	A'17(0.05)	B'23(0.05)	—	9	△□	□	□	△
17	A'18(0.05)	B'24(0.05)	—	25	△	△	X	△
18	—	B1(0.05)	B7(0.05)	30	○	◎	○	○
19	—	B1(0.05)	BB9(0.05)	5	◎	○◎	◎	◎
20	A1(0.05)	B'25(0.05)	—	0	△	△□	△	△

Note 7: Evaluation items, see Note 1 of Table 1.

Note 8: Types of emulsifier

A'16 Diglycerol monoesters of fatty acids

Constituent fatty acids: lauric acid 99wt.%

Monoester content: 90wt.%

A'17 Diglycerol monoesters of fatty acids

Constituent fatty acids: palmitic acid 55wt.%

stearic acid 45wt.%

Monoester content: 70wt.%

A'18 Diglycerol monoesters of fatty acids

Constituent fatty acids: myristic acid 99wt.%

Monoester content: 40wt.%

- B'21 Lecithin (Used DX Lecithin made by Nisshin Seiu Co.)
- B'22 Mono-and diglycerides of fatty acids
(Used EMULSEE-HR0 made by Riken Vitamin Co., Ltd.)
Constituent fatty acids: oleic acid 75wt.%
- B'23 Lecithin (Used Lecithin PK made by Riken Vitamin Co.)
- B'24 Sucrose esters of fatty acids
(Used RYOTO ER-290 made by Mitsubishi Chemical Corp.)
Constituent fatty acids: erucic acid 90wt.%
- B'25 Propylen glycol esters of fatty acids
(Used RIKEMUL PS-100 made by Riken Vitamin Co.)
Constituent fatty acids: stearic acid 70wt.%, palmitic acid 30wt.%
- B9 Sucrose esters of fatty acids
(Used RYOTO P-1670 made by Mitsubishi Chemical Corp.)
Constituent fatty acids: palmitic acid 80wt.%
HLB: 16

As the above, with the milk-constituent-containing beverage by the present invention, since the germination of spores of and proliferation heat-resistant spore-forming bacteria are suppressed, flat sour deterioration is prevented, and problems such as coagulation, oiling off, feathering, precipitation, neck ring, etc. of the milk constituents do not occur, the problems mentioned above are solved even for cases where the ocverage is stored under heated conditions in a vending machine, etc.



WHAT IS CLAIMED IS:

1. A milk-constituent-containing beverage containing (A) diglycerol monoesters of fatty acids and (B) at least one emulsifier selected from a group comprised of citric acid esters of mono-and diglycerides of fatty acids, succinic acid esters of mono-and diglycerides of fatty acids, diacetyltartaric acid esters of mono-and diglycerides of fatty acids, polyglycerin monoesters of fatty acids with an HLB of 3 to 16, and sucrose esters of fatty acids with an HLB of 3 to 16, said beverage being characterized in that 70wt.% or more of the fatty acid composition of the diglycerol monoesters of fatty acids is taken up by the total amount of myristic acid and/or palmitic acid and in that the monoester content of the diglycerol monoesters of fatty acids is 70wt.% or more.

2. A milk-constituent-containing beverage, which is provided with growth inhibition effects against heat-resistant spore-forming bacteria and in which such problems as coagulation, oiling off, feathering, precipitation, neck ring, etc. of the milk constituents are suppressed, said milk-constituent-containing beverage containing (A) diglycerol monoesters of fatty acids and (B) at least one emulsifier selected from a group comprised of citric acid esters of mono-and diglycerides of fatty acids, succinic acid esters mono-and diglycerides of fatty acids, diacetyltartaric acid esters of mono-and diglyceride of fatty acids, polyglycerin monoesters of fatty acids with an HLB of 3 to 16, and sucrose esters of fatty acids with an HLB of 3 to 16, said beverage being characterized in that 70wt.% or more of the fatty acid composition of the diglycerol monoesters of fatty acids is taken up by the total amount of myristic acid and/or palmitic acid and in that the monoester content of the diglycerol monoesters of fatty acids is 70wt.% or more.



3. A milk-constituent-containing beverage as set forth in claim 1 or 2, wherein the added amount of the diglycerol monoesters of fatty acids (A) is 0.01 to 1.0wt.%.

4. A milk-constituent-containing beverage as set forth in any of claims 1 through 3, wherein the added amount of the at least one emulsifier (B), selected from a group comprised of citric acid esters mono-and diglycerides of fatty acids, succinic acid esters of mono-and diglycerides fatty acids, diacetyltartaric acid esters of mono-and diglycerides of fatty acids, polyglycerin monoesters of fatty acids with an HLB of 3 to 16, and sucrose esters of fatty acids with an HLB of 3 to 16, is 0.002 to 0.3wt.%.

ABSTRACT

MILK-CONSTITUENT-CONTAINING BEVERAGE

The present invention is relating to milk-constituent-containing beverages which are preserved and distributed in metal cans, and characterized that a milk-constituent-containing beverage, which is provided with growth inhibition effects against heat-resistant spore-forming bacteria and in which such problems as coagulation, oiling off, feathering, precipitation, neck ring, etc. of the milk constituents are suppressed, said milk-constituent-containing beverage containing (A) diglycerol monoesters of fatty acids and (B) at least one emulsifier selected from a group comprised of citoric acid esters of mono- and diglycerides of fatty acids, guccinic acid esters of mono- and diglycerides of fatty acids, diacetyltartaric acid esters of mono- and diglycerides of fatty acids, polyglycerin monoesters of fatty acids with an HLB of 3 to 16, and sucrose esters of fatty acids with an HLB of 3 to 16, said beverage being characterized in that 70wt.% or more of the fatty acid composition of the diglycerol monoesters of fatty acids is taken up by the total amount of myristic acid and/or palmitic acid and in that the monoester content of the ester composition of the diglycerin fatty acid monoester is 70wt.% or more.