Patent Literature 2: JP Patent Publication No.2014-094001 A

Patent Literature 3: International Publication WO2007/052081

Patent Literature 4: International Publication WO2011/049205

Non Patent Literature

[0007]

Non Patent Literature 1: Fumitaka Hayase, "Browning", Journal of the Japanese Society of Food Science and Technology, 36 (1), p. 89-90 (1989)

Summary

Technical Problem

[0008]

The problem underlying the present disclosure is to provide a fermentation promoting agent for *Streptococcus thermophilus*, that is suitable for use in food production.

Solution to Problem

[0009]

The present inventors conducted intensive studies to solve the above-mentioned problem, and have found that the fermentation of *Streptococcus thermophilus* can be promoted effectively by a colored solution obtained by exposing an alkaline solution containing a reducing sugar to a temperature in a certain range to induce a color reaction of sugar, whereby the present disclosure was accomplished.

[0009a]

Thus, in one aspect, the present disclosure refers to a fermentation promoting agent for *Streptococcus thermophilus*, wherein the agent has a fermentation promoting effect on *Streptococcus thermophilus*, and comprises, as an active ingredient, a solution prepared by exposing an alkaline solution comprising a reducing sugar to a temperature in the range of 5°C or more and 135°C or less to induce a color reaction of sugar. In another aspect, the present disclosure refers to a method for producing a fermentation promoting agent for *Streptococcus thermophilus*, wherein the agent has a fermentation promoting effect on *Streptococcus*

thermophilus, and the method comprises exposing an alkaline solution comprising a reducing sugar to a temperature in the range of 5°C or more and 135°C or less to induce a color reaction of sugar, thereby preparing a solution having a fermentation promoting effect on *Streptococcus thermophilus*, and producing the fermentation promoting agent for *Streptococcus thermophilus* using it as an active ingredient. In yet another aspect, the present disclosure refers to a method for promoting *Streptococcus thermophilus* fermentation, comprising adding the fermentation promoting agent as disclosed herein to a fermentation substrate and culturing *Streptococcus thermophilus* in/on the fermentation substrate to ferment the fermentation substrate. In yet another aspect, the present disclosure refers to a method for producing a milk-fermented food, comprising fermenting a fermentation substrate comprising milk or a milk-derived product with a method for promoting *Streptococcus thermophilus* fermentation that comprises adding a fermentation promoting agent for *Streptococcus thermophilus* as disclosed herein to the fermentation substrate and culturing *Streptococcus thermophilus* in/on the fermentation substrate to ferment the fermentation substrate.

[0010]

More specifically, the present disclosure encompasses the followings.

[1] A fermentation promoting agent for *Streptococcus thermophilus*, comprising a solution prepared by exposing an alkaline solution comprising a reducing sugar to a temperature in the range of 5°C or more and 135°C or less to induce a color reaction of sugar.

[2] The fermentation promoting agent according to the above [1], wherein said temperature is 35°C or more.

[3] The fermentation promoting agent according to the above [1] or [2], wherein said

Advantageous Effects of Disclosure

[0012]

According to the present disclosure, the fermentation of *Streptococcus thermophilus* can be promoted even with a small amount of fermentation promoting agent added.

Brief Description of Drawings

[0013]

[Figure 1] Figure 1 is a photograph showing the influence of temperature on the color tone of a 50% lactose solution prepared with a 25% NaOH solution. It shows, in order from the leftmost tube, samples kept at -20°C, 5°C, 25°C and 37°C and a sample heat-treated at 95°C.

[Figure 2] Figure 2 shows the influence of temperature on the fermentation promoting effect on *S. thermophilus* of a lactose-NaOH solution (addition rate of 0.0025% (vol/wt)). Solid square, -20°C; solid triangle, 5°C; solid diamond, 25°C; ×, 37°C; open square, 95°C; and open circle, control. The unit H of the fermentation time on the horizontal axis denotes time [hour(s)] (the same applies to the following figures).

[Figure 3] Figure 3 shows the influence of temperature on the fermentation promoting effect on *S. thermophilus* of a lactose-NaOH solution (addition rate of 0.0125% (vol/wt)). Solid square, -20°C; solid triangle, 5°C; solid diamond, 25°C; and open circle, control.

[Figure 4] Figure 4 shows the fermentation promoting effect on *S. thermophilus* of a 0.1% lactose solution prepared with a 0.1% NaOH solution (addition rate of a lactose-NaOH solution: 1%). Solid square, an unheated lactose-NaOH solution; solid triangle, a heated lactose-NaOH solution; and open circle, control.

[Figure 5] Figure 5 shows the fermentation promoting effect on *S. thermophilus* of a 0.1% lactose solution prepared with a 0.1% NaOH solution (addition rate of a lactose-NaOH solution: 10%). Solid square, an unheated lactose-NaOH solution; solid triangle, a heated lactose-NaOH solution; and open circle, control.

[Figure 6] Figure 6 shows the influence of the concentration of a NaOH solution on the fermentation promoting effect. Solid square, 0% NaOH; solid triangle, 0.8% NaOH; solid

grape juice; solid triangle, grape juice + 10% NaOH; and open circle, control.

[Figure 16] Figure 16 shows the fermentation promoting effect on *S. thermophilus* of a solution prepared by adding NaOH to 100% fruit juice of grapefruit and heating it. Solid square, grapefruit juice; solid triangle, grapefruit juice + 10% NaOH; and open circle, control.

[Figure 17] Figure 17 shows the fermentation promoting effect on *S. thermophilus* of a solution prepared by adding NaOH to 100% fruit juice of orange and heating it. Solid square, orange juice; solid triangle, orange juice + 10% NaOH; and open circle, control.

[Figure 18] Figure 18 shows the fermentation promoting effect on *S. thermophilus* of a solution prepared by adding NaOH to 100% fruit juice of apple and heating it. Solid square, apple juice; solid triangle, apple juice + 10% NaOH; and open circle, control.

[Figure 19] Figure 19 is a photograph showing the color tone after heating of a solution prepared by adding NaOH to a fruit juice or a reconstituted skim milk (SMP).

[Figure 20] Figure 20 shows the fermentation promoting effect on *S. thermophilus* of a sugar-alkaline solution prepared with a reconstituted skim milk (SMP). Solid square, 10% SMP added; solid triangle, 10% SMP + 5% NaOH added; and open circle, control.

[Figure 21] Figure 21 shows the fermentation promoting effect of a sugar-alkaline solution on *S. thermophilus* OLS3059 strain.

[Figure 22] Figure 22 shows the fermentation promoting effect of a sugar-alkaline solution on *S. thermophilus* OLS3294 strain.

[Figure 23] Figure 23 shows the fermentation promoting effect of a sugar-alkaline solution on *S. thermophilus* OLS3289 strain.

[Figure 24] Figure 24 shows the fermentation promoting effect of a sugar-alkaline solution on *S. thermophilus* OLS3469 strain.

[Figure 25] Figure 25 shows the fermentation promoting effect of a sugar-alkaline solution on *S. thermophilus* OLS3058 strain.

[Figure 26] Figure 26 shows the fermentation promoting effect of a sugar-alkaline solution on *S. thermophilus* OLS3290 strain.

[Figure 27] Figure 27 shows the fermentation promoting effect, with an acidity as the indicator, of a sugar-alkaline solution in mixed fermentation of *S. thermophilus* and *L. bulgaricus*.

Claims

1. A fermentation promoting agent for *Streptococcus thermophilus*, wherein the agent has a fermentation promoting effect on *Streptococcus thermophilus*, and comprises, as an active ingredient, a solution prepared by exposing an alkaline solution comprising a reducing sugar to a temperature in the range of 5°C or more and 135°C or less to induce a color reaction of sugar.

2. The fermentation promoting agent according to claim 1, wherein said temperature is 35°C or more.

3. The fermentation promoting agent according to claim 1 or 2, wherein said exposing to the temperature is carried out by heating the alkaline solution comprising a reducing sugar at 35 to 100°C.

4. The fermentation promoting agent according to any one of claims 1 to 3, wherein the alkaline solution comprising a reducing sugar comprises 0.05 to 80 wt% of the reducing sugar.

5. The fermentation promoting agent according to any one of claims 1 to 4, wherein the reducing sugar is at least one selected from the group consisting of glucose, galactose, fructose, arabinose, rhamnose, xylose, lactose, lactulose, galactooligosaccharide and dextrin.

6. The fermentation promoting agent according to any one of claims 1 to 5, wherein the alkaline solution comprising a reducing sugar comprises 0.05 to 30 wt% of a hydroxide.

7. The fermentation promoting agent according to any one of claims 1 to 6, wherein the alkaline solution comprising a reducing sugar comprises at least one of sodium hydroxide and potassium hydroxide as the hydroxide.

8. The fermentation promoting agent according to claim 7, wherein the reducing sugar is

lactose and the hydroxide is sodium hydroxide or potassium hydroxide.

9. The fermentation promoting agent according to any one of claims 1 to 8, wherein the alkaline solution comprising a reducing sugar comprises a food material comprising a reducing sugar.

10. The fermentation promoting agent according to claim 9, wherein said food material is at least one of a fruit juice and a reconstituted skim milk.

11. A method for producing a fermentation promoting agent for *Streptococcus thermophilus*, wherein the agent has a fermentation promoting effect on *Streptococcus thermophilus*, and the method comprises exposing an alkaline solution comprising a reducing sugar to a temperature in the range of 5°C or more and 135°C or less to induce a color reaction of sugar, thereby preparing a solution having a fermentation promoting effect on *Streptococcus thermophilus*, and producing the fermentation promoting agent for *Streptococcus thermophilus* using it as an active ingredient.

12. The method according to claim 11, wherein said temperature is 35°C or more.

13. The method according to claim 11 or 12, wherein said exposing to the temperature is carried out by heating the alkaline solution comprising a reducing sugar at 35 to 100°C.

14. The method according to any one of claims 11 to 13, wherein the alkaline solution comprising a reducing sugar comprises 0.05 to 80 wt% of the reducing sugar.

15. The method according to any one of claims 11 to 14, wherein the reducing sugar is at least one selected from the group consisting of glucose, galactose, fructose, arabinose, rhamnose, xylose, lactose, lactulose, galactooligosaccharide and dextrin.

16. The method according to any one of claims 11 to 15, wherein the alkaline solution comprising a reducing sugar comprises 0.05 to 30 wt% of a hydroxide.

17. The method according to any one of claims 11 to 16, wherein the alkaline solution comprising a reducing sugar comprises at least one of sodium hydroxide and potassium hydroxide as the hydroxide.

18. The method according to claim 17, wherein the reducing sugar is lactose and the hydroxide is sodium hydroxide or potassium hydroxide.

19. The method according to any one of claims 11 to 18, wherein the alkaline solution comprising a reducing sugar comprises a food material comprising a reducing sugar.

20. The method according to claim 19, wherein said food material is at least one of a fruit juice and a reconstituted skim milk.

21. A method for promoting *Streptococcus thermophilus* fermentation, comprising adding the fermentation promoting agent according to any one of claims 1 to 10 to a fermentation substrate and culturing *Streptococcus thermophilus* in/on the fermentation substrate to ferment the fermentation substrate.

22. The method according to claim 21, wherein *Streptococcus thermophilus* and *Lactobacillus bulgaricus* are mixed-cultured in/on the fermentation substrate.

23. A method for producing a milk-fermented food, comprising fermenting a fermentation substrate comprising milk or a milk-derived product with a method for promoting *Streptococcus thermophilus* fermentation that comprises adding a fermentation promoting agent for *Streptococcus thermophilus* according to any one of claims 1 to 10 to the fermentation substrate and culturing *Streptococcus thermophilus* in/on the fermentation

substrate to ferment the fermentation substrate.

24. The method according to claim 23, wherein *Streptococcus thermophilus* and *Lactobacillus bulgaricus* are mixed-cultured in/on the fermentation substrate.

25. The method according to claim 23 or 24, wherein the milk-fermented food is fermented milk.