

DESCRIPTION

TITLE OF INVENTION: CHEESE AND METHOD FOR MANUFACTURING THE SAME

TECHNICAL FIELD

[0001]

The present invention relates to a cheese having water resistance and freezing resistance and a method for manufacturing the same.

BACKGROUND ART

[0002]

Cheese contains a good balance of various nutrients such as proteins, fats, calcium, vitamins, and minerals, and is attracting attention as a good source of calcium. In addition, cheese goes well with a variety of food products and is often used in processed food products.

For example, cheese is added to processed meat products such as hamburgers, and also used in combination with fish-paste products such as kamaboko. For such a combined use with other products such as processed meat products and fish paste products, a cheese having water resistance is required.

Mozzarella and other cheeses are often stored and

distributed in a liquid-immersed state or in a liquid-immersed and frozen state in order to maintain their freshness and shape.

However, when a typical processed cheese is immersed in water, its structure softens and the cheese melts, and after freezing and thawing, the cheese loses its shape retention property and becomes even softer. This has been a problem.

[0003]

Patent Document 1 addresses the problems that occur when food products are frozen and discloses a cheese product including a lump of cheese and an aqueous solution held in a container composed of a flexible film, in which the amount of the aqueous solution is adjusted to allow the whole lump of cheese to be immersed in the aqueous solution, and the amount of the aqueous solution is adjusted at 100 mass parts or less relative to 100 mass parts of the lump of cheese. Such a configuration can prevent hole formation in the container during frozen transportation.

However, the object of this invention is just that when a product including mozzarella cheese and liquid held in a container composed of a flexible film, such as a standing pouch, is frozen and transported in a frozen state, hole formation in the container caused by interference between the products during transportation can be prevented,

not that cheese deterioration caused by freezing can be prevented.

[0004]

Patent Document 2 describes a method for enhancing the freezing resistance of a food product, and the method includes addition of alginic acid, treatment with a divalent or trivalent metal salt, and treatment with a basic compound in the production of konjac and can provide a konjac that retains its texture even after freezing and thawing. Patent Document 3 also describes a method for enhancing the freezing resistance of a food product, and the method includes modifying the freezing resistance of jelly by addition of native gellan gum. The method can provide a freezing and thawing resistant jelly that retains its elasticity and shape retention property even after freezing and subsequent thawing, is substantially free from syneresis after thawing, has an excellent texture in a frozen state, and recovers, after thawing, the same texture as the jelly originally has before freezing. However, neither of these methods is applicable to cheese production.

[0005]

Patent Document 4 is intended to obtain a cheese that has good heat-resistant shape retention property under any heating condition, is unlikely to lose cheese flavor, and can be manufactured in a simple and easy method, and this

document proposes a cheese manufacturing method including mixing natural cheese with glucomannan in an amount of 0.5 to 3.0 wt% and without any melting salt or with a melting salt in an amount of 3.0 wt% or less, making an adjustment so that the final moisture content of a product is 40 to 90%, and emulsifying the mixture by heating and melting it in the usual manner. However, there is no description on the water and freezing resistance of cheese, the amount of the melting salt added is different from that in the present invention, and the problem to be solved is also different.

[0006]

Patent Document 5 discloses providing soft cheese that contains specified amounts of gum, starch, and dextrin and retains a characteristic texture of soft cheese and its commercial value even after freezing.

However, no improvement in the water resistance of the cheese is observed.

CITATION LIST

PATENT LITERATURE

[0007]

Patent Document 1: JP2022-035749A

Patent Document 2: JPS61-166378A

Patent Document 3: JP3772233B

Patent Document 4: JPH09-294538A

SUMMARY OF INVENTION

TECHNICAL PROBLEM

[0008]

The present invention addresses the problem of providing a cheese having freezing resistance and water resistance.

SOLUTION TO PROBLEM

[0009]

The present inventors have found that a cheese that is water resistant and less prone to softening after freezing and thawing can be provided by mixing a raw material cheese with a condensed phosphate in an amount of 0.3 to 2.0 wt% and glucomannan in an amount of 0.03 to 0.50 wt% relative to the raw material cheese and then emulsifying the mixture, and finally completed the present invention.

[0010]

Aspects of the present invention are as follows.

[1] A cheese containing a condensed phosphate in an amount of 0.3 to 2.0 wt% and glucomannan in an amount of 0.03 to 0.50 wt% relative to a raw material cheese.

[2] A method for manufacturing a cheese having water resistance and freezing resistance, the method comprising

mixing a raw material cheese with a condensed phosphate in an amount of 0.3 to 2.0 wt% and glucomannan in an amount of 0.03 to 0.50 wt% relative to the raw material cheese and then emulsifying the mixture.

[0011]

The raw material cheese used in the present invention may be any cheese that is usually called cheese. Example of the raw material cheese include mozzarella, caciocavallo, scamorza, string cheese, cheddar, Gouda, Edam, and Parmesan. Among them, medium-mature raw material cheeses such as mozzarella and string cheese are preferably used.

[0012]

The condensed phosphate in the present invention may be any melting salt commonly used in cheese production. For example, sodium polyphosphate, sodium triphosphate, sodium diphosphate, sodium monophosphate, sodium citrate, calcium polyphosphate, calcium triphosphate, calcium diphosphate, calcium monophosphate, calcium citrate, and potassium salts are contemplated, and agents containing a mixture of any combination of these salts may be used. The turbidity of a 1.0% aqueous solution of such a condensed phosphate having an adjusted pH of 6.0 is preferably 2.0 or more.

[0013]

The amount of the condensed phosphate added only needs to be 0.3 to 2.0%, and preferably 0.5 to 1.5% relative to

the weight of the raw material cheese.

The addition of the condensed phosphate in an amount of less than 0.3% fails to provide a satisfactory structure, and the addition of the condensed phosphate in an amount of more than 2.0% results in the formation of an excessively firm structure; therefore, both cases have problems.

[0014]

The glucomannan used in the present invention may be in the form of powder or aqueous solution, or contained in an agent. The amount of the glucomannan added only needs to be 0.03 to 0.50%, and preferably 0.06 to 0.20% relative to the weight of the raw material cheese.

The addition of the glucomannan in an amount of less than 0.03% fails to provide the required water resistance and freezing resistance, and the addition of the glucomannan in an amount of more than 0.50% results in excessive hardening of cheese; therefore, both cases have problems.

[0015]

The hardness of the cheese in the present invention is preferably 3,000 to 14,000 gf, more preferably 4,000 to 13,000 gf, and still more preferably 6,000 to 12,500 gf.

[0016]

The turbidity of the aqueous solution in the present invention is preferably 0.0 to 0.6, more preferably 0.01 to 0.5, and still more preferably 0.05 to 0.4.

[0017]

In the present invention, the condensed phosphate and the glucomannan may be in the form of powder or in a dissolved state when added to the raw material cheese.

[0018]

For the emulsification in the present invention, any production machine commonly used in cheese production only needs to be used, and examples thereof include a shear emulsifying apparatus, a kettle-type emulsifying apparatus, and a kneader. Preferred are a kettle-type emulsifying apparatus and a kneader.

ADVANTAGEOUS EFFECTS OF INVENTION

[0019]

The cheese containing a condensed phosphate and glucomannan in specific amounts according to the present invention is water resistant and less prone to softening after freezing and thawing.

BRIEF DESCRIPTION OF DRAWINGS

[0020]

[Fig. 1] Fig. 1 is a graph showing the results of an experiment for evaluating water resistance.

[Fig. 2] Fig. 2 is a graph showing the results of an experiment for evaluating shape retention property.

[Fig. 3] Fig. 3 is a graph showing the results of an experiment for evaluating freezing resistance.

[Fig. 4] Fig. 4 is a graph showing the results of an experiment for evaluating shape retention property.

DESCRIPTION OF EMBODIMENTS

EXAMPLES

[0021]

Hereinafter, examples of the present invention are provided, but the present invention is not limited thereto.

[0022]

Water resistance test

[Example 1-1]

Three kilograms of Gouda cheese (made in Ireland) as a raw material cheese, 15 g of sodium polyphosphate (S233, manufactured by ICL JAPAN Ltd.) as a melting salt, of which a 1.0% aqueous solution had an adjusted pH of 6.0 and a turbidity of 2.0 or more, 15 g of glucomannan, and water (added to make a moisture content of 50 mass%) were fed into a kettle-type emulsifying apparatus (manufactured by Nichiraku Machinery Co., Ltd.) and heated up to 80°C with mixing. Once the temperature of the cheese reached 80°C, the cheese was ice-cooled. Thus, a processed cheese was obtained.

[0023]

[Example 1-2]

Three kilograms of Gouda cheese (made in Ireland) as a raw material cheese, 15 g of sodium polyphosphate (S233, manufactured by ICL JAPAN Ltd.) as a melting salt, of which a 1.0% aqueous solution had an adjusted pH of 6.0 and a turbidity of 2.0 or more, 6 g of glucomannan, 5.4 g of guar gum, 3.6 g of tamarind seed gum, and water (added to make a moisture content of 50 mass%) were fed into a kettle-type emulsifying apparatus (manufactured by Nichiraku Machinery Co., Ltd.) and heated up to 80°C with mixing. Once the temperature of the cheese reached 80°C, the cheese was ice-cooled. Thus, a processed cheese was obtained.

[0024]

[Example 1-3]

Three kilograms of Gouda cheese (made in Ireland) as a raw material cheese, 15 g of sodium polyphosphate (S233, manufactured by ICL JAPAN Ltd.) as a melting salt, of which a 1.0% aqueous solution had an adjusted pH of 6.0 and a turbidity of 2.0 or more, 1.8 g of glucomannan, 0.6 g of guar gum, and water (added to make a moisture content of 50 mass%) were fed into a kettle-type emulsifying apparatus (manufactured by Nichiraku Machinery Co., Ltd.) and heated up to 80°C with mixing. Once the temperature of the cheese reached 80°C, the cheese was ice-cooled. Thus, a processed cheese was obtained.

[0025]

[Comparative Example 1-1]

Three kilograms of Gouda cheese (made in Ireland) as a raw material cheese, 15 g of sodium citrate as a melting salt, and water (added to make a moisture content of 50 mass%) were fed into a kettle-type emulsifying apparatus (manufactured by Nichiraku Machinery Co., Ltd.) and heated up to 80°C with mixing. Once the temperature of the cheese reached 80°C, the cheese was ice-cooled. Thus, a processed cheese was obtained.

[0026]

[Comparative Example 1-2]

Three kilograms of Gouda cheese (made in Ireland) as a raw material cheese, 15 g of sodium monophosphate as a melting salt, and water (added to make a moisture content of 50 mass%) were fed into a kettle-type emulsifying apparatus (manufactured by Nichiraku Machinery Co., Ltd.) and heated up to 80°C with mixing. Once the temperature of the cheese reached 80°C, the cheese was ice-cooled. Thus, a processed cheese was obtained.

[0027]

[Comparative Example 1-3]

Three kilograms of Gouda cheese (made in Ireland) as a raw material cheese, 15 g of sodium citrate as a melting salt, 5.4 g of guar gum, 3.6 g of tamarind seed gum, and

water (added to make a moisture content of 50 mass%) were fed into a kettle-type emulsifying apparatus (manufactured by Nichiraku Machinery Co., Ltd.) and heated up to 80°C with mixing. Once the temperature of the cheese reached 80°C, the cheese was ice-cooled. Thus, a processed cheese was obtained.

[0028]

[Comparative Example 1-4]

Three kilograms of Gouda cheese (made in Ireland) as a raw material cheese, 15 g of sodium monophosphate as a melting salt, 5.4 g of guar gum, 3.6 g of tamarind seed gum, and water (added to make a moisture content of 50 mass%) were fed into a kettle-type emulsifying apparatus (manufactured by Nichiraku Machinery Co., Ltd.) and heated up to 80°C with mixing. Once the temperature of the cheese reached 80°C, the cheese was ice-cooled. Thus, a processed cheese was obtained.

[0029]

[Comparative Example 1-5]

Three kilograms of Gouda cheese (made in Ireland) as a raw material cheese, 15 g of sodium polyphosphate (S233, manufactured by ICL JAPAN Ltd.) as a melting salt, of which a 1.0% aqueous solution had an adjusted pH of 6.0 and a turbidity of 2.0 or more, and water (added to make a moisture content of 50 mass%) were fed into a kettle-type emulsifying

apparatus (manufactured by Nichiraku Machinery Co., Ltd.) and heated up to 80°C with mixing. Once the temperature of the cheese reached 80°C, the cheese was ice-cooled. Thus, a processed cheese was obtained.

[0030]

[Comparative Example 1-6]

Three kilograms of Gouda cheese (made in Ireland) as a raw material cheese, 15 g of sodium polyphosphate (Cheesemin No. 1, manufactured by Mitsui Sugar Co., Ltd.) as a melting salt, and water (added to make a moisture content of 50 mass%) were fed into a kettle-type emulsifying apparatus (manufactured by Nichiraku Machinery Co., Ltd.) and heated up to 80°C with mixing. Once the temperature of the cheese reached 80°C, the cheese was ice-cooled. Thus, a processed cheese was obtained.

[0031]

Water resistance evaluation

Each of the 9 different cheeses described above was cut into 1.5 cm square dices. Each dice was placed in an aqueous solution containing 0.5% calcium lactate and 0.5% sodium salt dissolved, and stored at 10°C for 2 weeks. Then, the degree of cloudiness of each aqueous solution was determined.

The degree of cloudiness was measured using a spectrophotometer, and the absorbance measured at a

wavelength of 660 nm was regarded as "turbidity".

[0032]

Hardness measurement

After the water resistance evaluation described above, the moisture on the surface of each cheese dice was wiped off. Each dice was mounted on a texture analyzer (manufactured by EKO Instruments Co., Ltd.), and the maximum stress measured when the dice was compressed using a 75 mm-diameter disc-shaped jig at a speed of 0.5 mm/second was regarded as hardness (gf).

[0033]

[Table 1]

	Natural cheese	Melting salt		Polysaccharide		Turbidity [-]	Hardness [g]
		Type	Amount	Type	Amount		
Example1-1	Gouda	S233 (Sodium polyphosphate)	0.50%	Glucomannan	0.50%	0.1	10000
Example1-2	Gouda	S233 (Sodium polyphosphate)	0.50%	Glucomannan Guar gum	0.2% 0.18%	0.05	8000
Example1-3	Gouda	S233 (Sodium polyphosphate)	0.50%	Glucomannan Guar gum	0.06% 0.02%	0.2	7500
Comparative Example1-1	Gouda	Sodium citrate	0.50%			0.75	800
Comparative Example1-2	Gouda	Tnew (Sodium monophosphate)	0.50%			0.72	610
Comparative Example1-3	Gouda	Sodium citrate	0.50%	Guar gum Tamarind seed gum	0.18% 0.12%	0.8	500
Comparative Example1-4	Gouda	Tnew (Sodium monophosphate)	0.50%	Guar gum Tamarind seed gum	0.18% 0.12%	0.72	310
Comparative Example1-5	Gouda	S233 (Sodium polyphosphate)	0.50%			0.05	760
Comparative Example1-6	Gouda	CM1 (Sodium polyphosphate)	0.50%			0.7	250

[0034]

As clearly shown in Figs. 1 and 2, the cheeses

containing a condensed phosphate and glucomannan in amounts within the range specified in the present invention did not show any marked increase in turbidity, retained an excellent hardness, and had an excellent water resistance.

[0035]

Freezing resistance test

[Example 2-1]

Three kilograms of Gouda cheese (made in Ireland) as a raw material cheese, 15 g of sodium polyphosphate (S233, manufactured by ICL JAPAN Ltd.) as a melting salt, of which a 1.0% aqueous solution had an adjusted pH of 6.0 and a turbidity of 2.0 or more, 15 g of glucomannan, and water (added to make a moisture content of 50 mass%) were fed into a kettle-type emulsifying apparatus (manufactured by Nichiraku Machinery Co., Ltd.) and heated up to 80°C with mixing. Once the temperature of the cheese reached 80°C, the cheese was ice-cooled. Thus, a processed cheese was obtained.

[0036]

[Example 2-2]

Three kilograms of Gouda cheese (made in Ireland) as a raw material cheese, 15 g of sodium polyphosphate (S233, manufactured by ICL JAPAN Ltd.) as a melting salt, of which a 1.0% aqueous solution had an adjusted pH of 6.0 and a turbidity of 2.0 or more, 1.8 g of glucomannan, 0.6 g of

guar gum, and water (added to make a moisture content of 50 mass%) were fed into a kettle-type emulsifying apparatus (manufactured by Nichiraku Machinery Co., Ltd.) and heated up to 80°C with mixing. Once the temperature of the cheese reached 80°C, the cheese was ice-cooled. Thus, a processed cheese was obtained.

[0037]

[Comparative Example 2-1]

Three kilograms of Gouda cheese (made in Ireland) as a raw material cheese and water (added to make a moisture content of 50 mass%) were fed into a kettle-type emulsifying apparatus (manufactured by Nichiraku Machinery Co., Ltd.) and heated up to 80°C with mixing. Once the temperature of the cheese reached 80°C, the cheese was ice-cooled. Thus, a processed cheese was obtained.

[0038]

[Comparative Example 2-2]

Three kilograms of Gouda cheese (made in Ireland) as a raw material cheese, 15 g of sodium citrate as a melting salt, and water (added to make a moisture content of 50 mass%) were fed into a kettle-type emulsifying apparatus (manufactured by Nichiraku Machinery Co., Ltd.) and heated up to 80°C with mixing. Once the temperature of the cheese reached 80°C, the cheese was ice-cooled. Thus, a processed cheese was obtained.

[0039]

[Comparative Example 2-3]

Three kilograms of Gouda cheese (made in Ireland) as a raw material cheese, 15 g of sodium citrate as a melting salt, 5.4 g of guar gum, 3.6 g of tamarind seed gum, and water (added to make a moisture content of 50 mass%) were fed into a kettle-type emulsifying apparatus (manufactured by Nichiraku Machinery Co., Ltd.) and heated up to 80°C with mixing. Once the temperature of the cheese reached 80°C, the cheese was ice-cooled. Thus, a processed cheese was obtained.

[0040]

[Comparative Example 2-4]

Three kilograms of Gouda cheese (made in Ireland) as a raw material cheese, 15 g of sodium polyphosphate (Cheesemin No. 1, manufactured by Mitsui Sugar Co., Ltd.) as a melting salt, and water (added to make a moisture content of 50 mass%) were fed into a kettle-type emulsifying apparatus (manufactured by Nichiraku Machinery Co., Ltd.) and heated up to 80°C with mixing. Once the temperature of the cheese reached 80°C, the cheese was ice-cooled. Thus, a processed cheese was obtained.

[0041]

Freezing resistance evaluation

Each of the 6 different cheeses described above was

cut into 1.5 cm square dices. Each dice was placed in an aqueous solution containing 0.5% calcium lactate and 0.5% sodium salt dissolved, frozen at -25°C for 24 hours or more, and then thawed at 10°C for 12 hours. The degree of cloudiness of each aqueous solution after 2 weeks was determined.

The degree of cloudiness was measured using a spectrophotometer, and the absorbance measured at a wavelength of 660 nm was regarded as "turbidity".

[0042]

Hardness measurement

After thawing, each cheese dice was kept at 10°C, and the moisture on the surface of each cheese dice was wiped off. Each dice was mounted on a texture analyzer (manufactured by EKO Instruments Co., Ltd.), and the maximum stress measured when the dice was compressed using a 75 mm-diameter disc-shaped jig at a speed of 0.5 mm/second was regarded as hardness (gf).

[0043]

The compositions and measurement results for each experiment described above are shown in Table 2, and the comparisons of the measured values are shown in Figs. 3 and 4.

In the present invention, "chilled" means that a sample is kept at a temperature range of 10°C or less without

freezing; and "frozen-to-chilled" means that after frozen, a sample is kept at a temperature range of 10°C or less without freezing. Accordingly, the samples in the present invention were frozen at -25°C for 24 hours or more, and then thawed at 10°C for 12 hours.

[0044]

[Table 2]

	Natural cheese	Melting salt		Polysaccharide			Turbidity [-]	Hardness [g]
		Type	Amount	Type	Amount			
Example2-1	Gouda	S233 (Sodium polyphosphate)	0.50%	Glucomannan	0.50%	Refrigerated	0.38	10132
	Gouda	S233 (Sodium polyphosphate)	0.50%	Glucomannan	0.50%	Frozen-to-chilled	0.4	12150
Example2-2	Gouda	S233 (Sodium polyphosphate)	0.50%	Glucomannan Guar gum	0.06% 0.02%	Refrigerated	0.22	10928
	Gouda	S233 (Sodium polyphosphate)	0.50%	Glucomannan Guar gum	0.06% 0.02%	Frozen-to-chilled	0.3	11286
Comparative Example2-1	Gouda					Chilled	0.8	1068
	Gouda					Frozen-to-chilled	0.9	950
Comparative Example2-2	Gouda	Sodium citrate	0.50%			Chilled	0.75	2050
	Gouda	Sodium citrate	0.50%			Frozen-to-chilled	0.82	1700
Comparative Example2-3	Gouda	Sodium citrate	0.50%	Guar gum Tamarind seed gum	0.18% 0.12%	Chilled	0.8	1500
	Gouda	Sodium citrate	0.50%	Guar gum Tamarind seed gum	0.18% 0.12%	Frozen-to-chilled	0.8	1100
Comparative Example2-4	Gouda	CM1 (Sodium polyphosphate)	0.50%			Chilled	0.7	2000
	Gouda	CM1 (Sodium polyphosphate)	0.50%			Frozen-to-chilled	0.73	1600

[0045]

Freezing resistance evaluation

In Fig. 3, the refrigerated stored samples are shown

in black, and the frozen-to-chilled samples are shown in white. As clearly shown in the graph, frozen-to-chilled storage did not cause any marked increase in turbidity, and the cheeses containing a condensed phosphate and glucomannan in amounts within the range specified in the present invention had an excellent water resistance, whether refrigerated stored or frozen-to-chilled.

[0046]

The hardness of each cheese was measured using a rheometer and evaluated on the basis of the measured value. In Fig. 4, the refrigerated stored samples are shown in black, and the frozen-to-chilled samples are shown in white. As clearly shown in the graph, frozen-to-chilled storage did not cause any marked decrease in hardness, and the cheeses containing a condensed phosphate and glucomannan in amounts within the range specified in the present invention had an excellent shape retention property, whether refrigerated stored or frozen-to-chilled.

CLAIMS

[Claim 1]

A cheese having water resistance and freezing resistance, the cheese containing a condensed phosphate in an amount of 0.3 to 2.0 wt% and glucomannan in an amount of 0.03 to 0.50 wt% relative to a raw material cheese.

[Claim 2]

A method for manufacturing a cheese having water resistance and freezing resistance, the method comprising mixing a raw material cheese with a condensed phosphate in an amount of 0.3 to 2.0 wt% and glucomannan in an amount of 0.03 to 0.50 wt% relative to the raw material cheese and then emulsifying the mixture.