

DESCRIPTION

TITLE OF THE INVENTION

BAKERY PRODUCT WITH EXCELLENT SLICABILITY AND METHOD FOR
PRODUCING SAME

Technical Field

[0001]

The present invention relates to a bakery product that is excellent in chewy texture and soft texture and also excellent in slice aptitude (mechanical property for slicing and cutting) during bakery product processing, and a method for producing the same.

Background Art

[0002]

Mochi (rice cake) is typically produced from glutinous rice steamed and pounded into paste. This traditional food has been favored since olden times because of its unique texture of gumminess, stickiness, and elasticity. In recent years, an increasing number of consumers have preferred food having chewy texture (mochi-like texture) upon eating. Accordingly, the number of products having chewy texture is also on the increase among bakery products. Particularly, bakery products not only having chewy texture but further having moist texture and soft texture upon eating have been demanded in the market. Such bakery products having chewy texture, however, tend to exhibit weakened chewy texture when their moist texture or soft texture is enhanced.

[0003]

Some methods have heretofore been disclosed as methods for conferring chewy texture to bakery products. Two methods for conferring chewy texture to bakery products are known, one of which employs a particular raw material and the other of which utilizes hot water-kneaded dough. For example, a method for producing a bakery product that is soft, albeit with elasticity, and is excellent in chewy texture, comprising combining a phosphate-cross-linked waxy corn starch with a pregelatinized starch is disclosed in Patent Document 1 as the method which employs a particular raw material. The waxy corn starch, however, has a characteristic grain-derived odor and therefore causes problems such as impairment of the original bakery flavor of the bakery product.

[0004]

Patent Document 2 discloses a method for producing a bread having chewy texture by use of a raw material powder consisting of 62 to 92.5 parts by mass of wheat flour, 7 to 30 parts by mass of a hydroxypropyl starch and/or an acetyl starch, and 0.5 to 8 parts by mass of a pregelatinized starch. Unfortunately, the bread tends to fail to have soft texture because of its purpose of merely conferring chewy texture thereto. Alternatively, Patent Document 3 discloses a method for producing a bread having chewy texture and moist texture using wheat flour, pregelatinized wheat flour and/or pregelatinized wheat starch, and α -amylase. The bread is made of a wheat-derived raw material and therefore, unfortunately, has

weaker chewy texture than that of a bread containing strong flour and an etherified starch.

[0005]

Thus, Patent Document 4 discloses a method for producing a bread enhanced in chewy texture, soft texture, moist texture, and melt-in-the-mouth, comprising preparing flour paste dough using waxy wheat flour or mixing waxy wheat flour and a pregelatinized starch into hot water-kneaded dough. The bread surely has well-balanced chewy texture and soft texture, which, however, cannot always satisfy recent consumers who prefer stronger chewy texture.

[0006]

On the other hand, for example, a method for producing hot water-kneaded dough for a bakery product, comprising at least mixing and kneading a hot water-kneaded dough ingredient containing at least wheat flour and an emulsion with the water temperature of an aqueous phase in the emulsion set to 80 to 100°C, the emulsion containing 3 to 90% by mass of an oil phase and 10 to 97% by mass of the aqueous phase is disclosed in Patent Document 5 as the second method for conferring chewy texture to bakery products using hot water-kneaded dough. Patent Document 6 discloses a bakery product produced using hot water-kneaded dough containing 0.05 to 7 parts by mass (in terms of solid content) of a milk raw material with respect to 100 parts by mass of cereal flours and/or starches, the milk raw material having a phospholipid content in a milk-derived solid content of 0.5% by mass or more with respect to the solid content. These methods which utilize hot water-kneaded dough require using hot

water of 80°C to 100°C during dough production and involve complicated steps. Also, these methods require strictly controlling the temperature of hot water. In addition, these methods tend to vary in final products and disadvantageously, cannot easily be applied to mass production.

[0007]

As described above, various methods are disclosed as the methods for conferring chewy texture to bakery products. Nevertheless, none of these disclosed methods can mass-produce bakery products having both chewy texture and soft texture. The problems associated with the production of such bakery products still remain to be solved.

[0008]

In addition to those described above, the following techniques for producing bakery products using waxy starch are disclosed: Patent Document 7 discloses a mix for bakery food containing a waxy potato starch as a main raw material powder and having a protein content of 0 to 4.0% by mass with respect to the whole mass of the mix, and bakery food having non-conventional appearance and texture obtained using the mix. Chewy texture is not conferred to the bakery food, though the Document states that the bakery food has clarity and softness. Alternatively, Patent Document 8 discloses a bakery food that is excellent in keeping quality and has soft texture and moist texture, the bakery food being produced using an ingredient containing 0.2 to 10 parts by mass of a pregelatinized modified waxy potato starch with respect to

100 parts by mass of raw material cereal flour comprising wheat flour as a main raw material. This invention is intended to confer soft texture and moist texture to the bakery product and does not confer chewy texture to the bakery product.

[0009]

Patent Document 9 discloses ready-to-use refrigeratable liquid dough for preparing pancakes, waffles, brownies, muffins, or cakes, comprising a starch component and an organic acid or an organic acid mixture, wherein the dough is microbiologically stabilized by heating at a temperature of 60°C to 72°C for a time sufficient for substantially reducing bacterial counts in the dough so that the dough can be stored at a temperature of 8°C or lower for at least 3 weeks and wherein the dough has water activity A_w larger than 0.90 and viscosity of 5,000 to 60,000 cP at 4°C and 0.3 rpm and can be stored for a long period, and a baked product obtained using the dough. A feature of this invention is to use a starch with a high gelatinization temperature in order to form a gel only during cooking. The Document states that the dough can be stored for a long period. Characteristic sourness is conferred to the dough due to the organic acid or the organic acid mixture contained therein as essential component and therefore, unfortunately, impairs the flavor of the bakery product.

[0010]

As described above, in bakery products, in order to respond to the recent consumer preferences for bakery products having chewy texture and further having moist

texture or soft texture upon eating, the challenge for the demands in this field is to provide bakery products having chewy texture and soft texture. Meanwhile, for bakery products, a slicing process is performed in the product processing thereof. This slicing process requires bakery products themselves to have the slice aptitude (mechanical property for slicing and cutting) for the slicing process. However, as described above, the slice aptitude of the bakery products for the slicing process is particularly of concern in the case of providing the bakery products having chewy texture and soft texture. Although the bakery products surely have chewy texture and soft texture, the problem occurring is that the slice surfaces of the bakery products are disadvantageously roughened in the secondary processing (slicing) step for the bakery products.

[0011]

Heretofore, methods for improving the slice aptitude (mechanical property for slicing and cutting) of bakery products for the slicing process in the product processing of the bakery products have also been disclosed. For example, Patent Document 10 discloses a method for producing breads that yield few pieces of slicing debris by producing the breads using a quality improving agent for breads consisting of an emulsified fat composition containing 0.01 to 5% by weight of carboxymethylcellulose (CMC) and/or a modified starch such as a phosphate-cross-linked, acetylated, and hydroxypropylated starch, 1 to 30% by weight of an emulsifier, and 10% by weight or more of fat. The method disclosed therein, however, cannot be

applied to bakery products that are not supplemented with an emulsifier, because of inevitable combined use with the emulsifier, and thus is not a widely applicable method.

[0012]

Also, Patent Documents 11 and 12 each disclose a method for producing breads or doughnuts provided with mechanical resistance to slicing or cutting after bread production, baking, or frying by preparing dough by the addition of a dough improving agent containing alginic acid ester to the dough in the production of the breads or the doughnuts. In the method disclosed therein, however, the dough improving agent influences the characteristics of bread dough. Thus, this method cannot be applied as a method for improving the slice aptitude of bakery products in the secondary processing (slicing) step in the production of bakery products having chewy texture and soft texture.

[0013]

As mentioned above, the challenge in this field is to provide bakery products having both chewy texture and soft texture and further having favorable slice aptitude for the slicing process in the product processing thereof. Thus, there is the task of developing a novel method for solving the challenge.

Prior Art Documents

Patent Documents

[0014]

Patent Document 1: Japanese unexamined Patent Application Publication No. 10-056946

Patent Document 2: Japanese unexamined Patent Application
Publication No. 10-295253

Patent Document 3: Japanese unexamined Patent Application
Publication No. 2003-199482

Patent Document 4: Japanese unexamined Patent Application
Publication No. 2010-057368

Patent Document 5: Japanese unexamined Patent Application
Publication No. 2004-000029

Patent Document 6: Japanese unexamined Patent Application
Publication No. 2009-201469

Patent Document 7: Japanese unexamined Patent Application
Publication No. 2013-179841

Patent Document 8: Japanese unexamined Patent Application
Publication No. 2007-325526

Patent Document 9: Japanese unexamined Patent Application
Publication No. 2004-512846

Patent Document 10: Japanese unexamined Patent Application
Publication No. 5-153897

Patent Document 11: Japanese unexamined Patent Application
Publication No. 2004-65245

Patent Document 12: Japanese unexamined Patent Application
Publication No. 2004-208703

Summary of the Disclosure

Object to be Solved by the Disclosure

[0015]

An object of the present disclosure is to provide a bakery product that is excellent in chewy texture and soft texture and also excellent in slice aptitude (mechanical

property for slicing) during bakery product processing, and a method for producing the same.

Means to Solve the Object

[0016]

The present inventors previously conducted diligent studies on the production of a bakery product that is excellent in chewy texture and soft texture. Consequently, the present inventors found that a bakery product that is excellent in chewy texture and also has soft texture can be produced by producing the bakery product using a starchy raw material for use in bakery product production, wherein the starchy raw material contains a particular part by mass of a waxy tapioca starch and/or a modified waxy tapioca starch with respect to the starchy raw material, and developed a method for providing a bakery product having chewy texture and soft texture (Japanese Patent Application No. 2014-040918). The present inventors have further conducted studies on the bakery product that is also excellent in slice aptitude during bakery product processing. Consequently, the present inventors have completed the present disclosure by finding that a bakery product that is excellent in chewy texture and soft texture and also excellent in slice aptitude during bakery product processing can be produced by producing the bakery product using a starchy raw material for use in bakery product production, wherein the starchy raw material contains a particular part by mass of a waxy tapioca starch and/or a modified waxy tapioca starch and a

particular part by mass of a phosphate-cross-linked non-waxy starch with respect to the starchy raw material.

[0016a]

In one aspect, there is provided a bakery product conferred with chewy texture, soft texture and slice aptitude, produced using a starchy raw material containing 1 to 20 parts by mass of a waxy tapioca starch and/or a modified waxy tapioca starch selected from a hydroxypropyl waxy tapioca starch, an acetyl waxy tapioca starch, and a waxy tapioca starch made by cross-linking the modified waxy tapioca starch, and 1 to 20 parts by mass of a phosphate-cross-linked non-waxy starch consisting of a phosphate-cross-linked starch having a sedimentation volume of 9.4 or less with respect to 100 parts by mass of the starchy raw material, in the starchy raw material used for the production of a bakery product.

[0016b]

In another aspect, there is provided a mix for bakery product production, containing 1 to 20 parts by mass of a waxy tapioca starch and/or a modified waxy tapioca starch selected from a hydroxypropyl waxy tapioca starch, an acetyl waxy tapioca starch, and a waxy tapioca starch made by cross-linking the modified waxy tapioca starch, and 1 to 20 parts by mass of a phosphate-cross-linked non-waxy starch consisting of a phosphate-cross-linked starch having a sedimentation volume of 9.4 or less with respect to 100 parts by mass of the starchy raw material, in the starchy raw material used for the production of a bakery product.

[0016c]

In another aspect, there is provided a method for producing a bakery product conferred with chewy texture, soft texture and slice aptitude, comprising using a mix for bakery product production containing 1 to 20 parts by mass of a waxy tapioca starch and/or a modified waxy tapioca starch selected from a hydroxypropyl waxy tapioca starch, an acetyl waxy tapioca starch, and a waxy tapioca starch made by cross-linking the modified waxy tapioca starch, and 1 to 20 parts by mass of a phosphate-cross-linked non-waxy starch consisting of a phosphate-cross-linked starch having a sedimentation volume of 9.4 or less with respect to 100 parts by mass of the starchy raw material, as a starchy raw material.

[0017]

Specifically, the present disclosure provides a bakery product provided with chewy texture, soft texture, and slice aptitude, the bakery product being produced using a starchy raw material for use in bakery product production, wherein the starchy raw material contains 1 to 20 parts by mass of a waxy tapioca starch and/or a modified waxy tapioca starch and 1 to 20 parts by mass of a phosphate-cross-linked non-waxy starch with respect to 100 parts by mass of the starchy raw material, and a method for producing the same. The method for producing a bakery product according to the present disclosure can be used in the production of various bakery products and can be applied to the production of a wide range of bakery products to produce a bakery product that

is excellent in chewy texture and soft texture and also excellent in slice aptitude during processing. This eliminates losses during secondary processing (slicing) and enables supply of a commodity with high product value.
[0018]

In the production of the bakery product of the present disclosure, examples of the modified waxy tapioca starch contained in the starchy raw material can include a hydroxypropyl waxy tapioca starch and/or an acetyl waxy tapioca starch. In the production of the bakery product of the present disclosure, examples of the phosphate-cross-linked non-waxy starch contained in the starchy raw material can include a phosphate-cross-linked starch

having a sedimentation volume of 9.4 or less. In the present disclosure, examples of the bakery product of interest can include a bread, a cake, a doughnut, a baked confectionery, and a non-fermented bread.

[0019]

Further, the present disclosure encompasses a mix for bakery product production comprising a starchy raw material for use in bakery product production, wherein the starchy raw material contains 1 to 20 parts by mass of a waxy tapioca starch and/or a modified waxy tapioca starch and 1 to 20 parts by mass of a phosphate-cross-linked non-waxy starch with respect to 100 parts by mass of the starchy raw material. Furthermore, the present disclosure encompasses a method for producing a bakery product provided with chewy texture, soft texture, and slice aptitude, comprising producing the bakery product using, as a starchy raw material, a mix for bakery product production comprising 1 to 20 parts by mass of a waxy tapioca starch and/or a modified waxy tapioca starch and 1 to 20 parts by mass of a phosphate-cross-linked non-waxy starch with respect to 100 parts by mass of the starchy raw material.

[0020]

More specifically, the present disclosure includes:

(1) A bakery product conferred with chewy texture, soft texture and slice aptitude, produced using a starchy raw material containing 1 to 20 parts by mass of a waxy tapioca starch and/or a modified waxy tapioca starch, and 1 to 20 parts by mass of a phosphate-cross-linked non-waxy starch with respect to 100 parts by mass of the starchy

raw material, in the starchy raw material used for the production of a bakery product.

(2) The bakery product according to (1), wherein the modified waxy tapioca starch is a hydroxypropyl waxy tapioca starch and/or an acetyl waxy tapioca starch.

(3) The bakery product according to (1) or (2), wherein the phosphate-cross-linked non-waxy starch is a phosphate-cross-linked starch having a sedimentation volume of 9.4 or less.

(4) The bakery product according to any one of (1) to (3), wherein the bakery product is a bread, a cake, a doughnut, a baked confectionery, or a non-fermented bread.

(5) A mix for bakery product production, containing 1 to 20 parts by mass of a waxy tapioca starch and/or a modified waxy tapioca starch, and 1 to 20 parts by mass of a phosphate-cross-linked non-waxy starch with respect to 100 parts by mass of the starchy raw material, in the starchy raw material used for the production of a bakery product.

(6) A method for producing a bakery product conferred with chewy texture, soft texture and slice aptitude, comprising using a mix for bakery product production containing 1 to 20 parts by mass of a waxy tapioca starch and/or a modified waxy tapioca starch, and 1 to 20 parts by mass of a phosphate-cross-linked non-waxy starch with respect to 100 parts by mass of the starchy raw material, as a starchy raw material.

Effect of the Invention

[0021]

The present invention provides a bakery product that is excellent in chewy texture and soft texture and also excellent in slice aptitude during bakery product processing. The method for producing a bakery product according to the present invention can be used in the production of various bakery products and can be applied to the production of a wide range of bakery products to produce a bakery product that is excellent in chewy texture and soft texture and also excellent in slice aptitude during processing. Thus, the present invention eliminates losses during secondary processing (slicing) and enables supply of a commodity with high product value.

Mode of Carrying Out the Invention

[0022]

The present invention provides a bakery product provided with chewy texture, soft texture, and slice aptitude, the bakery product being produced using a starchy raw material for use in bakery product production, wherein the starchy raw material contains 1 to 20 parts by mass of a waxy tapioca starch and/or a modified waxy tapioca starch and 1 to 20 parts by mass of a phosphate-cross-linked non-waxy starch with respect to 100 parts by mass of the starchy raw material, and a method for producing the same.

[0023]

In the production of the bakery product of the present invention, the "waxy tapioca starch" used in the

starchy raw material refers to a starch made of waxy tapioca as a raw material and composed almost 100% of amylopectin. A waxy tapioca starch produced by Siam Quality Starch Co., Ltd. (Thailand) using cassava roots of waxy tapioca obtained from Thai Tapioca Development Institute (Thailand) as a raw material can be used as the waxy tapioca starch.

[0024]

In the production of the bakery product of the present invention, an unmodified waxy tapioca starch and a modified waxy tapioca starch (physically and/or chemically modified form of the starch) can be used as the waxy tapioca starch contained in the starchy raw material. A pregelatinized waxy tapioca starch can be used as the physically modified waxy tapioca starch. In this context, the pregelatinized starch refers to a powdery starch obtained by the heating of a starch in the presence of water using a drum dryer, an extruder, a spray dryer, or the like and the drying of the starch thus pregelatinized, followed by pulverization according to the need. Non-pregelatinized starch is referred to as a starch or a β starch.

[0025]

In the production of the bakery product of the present invention, as a method of chemically modifying waxy tapioca starch contained in the starchy raw material, one or more methods selected from hydroxypropylation, acetylation, cross-linking, oxidation, and acid dipping can be used. Particularly preferred examples of the modified waxy tapioca starch can include a

hydroxypropylated and/or acetylated waxy tapioca starch. In this context, the hydroxypropylation refers to a treatment by which a starch is reacted with propylene oxide. The acetylation refers to a treatment by which a starch is reacted with an acetic anhydride or a vinyl acetate monomer or the like. These treatments can each be carried out according to a routine method. The cross-linking refers to a treatment by which a starch is reacted by the addition of a cross-linking agent such as metaphosphate and phosphorus oxychloride, and can be carried out according to a routine method. The oxidation refers to a treatment by which sodium hypochlorite is allowed to act on a starch. The acid dipping refers to a treatment by which sulfuric acid is allowed to act on a starch. These treatments can each be carried out according to a routine method.

[0026]

In the production of the bakery product of the present invention, a starch obtained by the aforementioned cross-linking treatment of a non-waxy starch can be used as the phosphate-cross-linked non-waxy starch contained in the starchy raw material. In the present invention, the non-waxy starch refers to a starch having an amylopectin content of 95% or less, preferably 90% or less, more preferably 85% or less. One or more types of starches selected from wheat starch, corn starch, potato starch, tapioca starch, rice starch, sago starch, sweet potato starch, pea starch, mung bean starch, and high-amylose corn starch can be used as the non-waxy starch. The non-waxy starch is subjected to phosphate cross-linking

treatment according to a routine method to obtain the phosphate-cross-linked non-waxy starch. The phosphate-cross-linked non-waxy starch may be further subjected to an additional modification treatment, for example, phosphoric acid monoesterification treatment.

[0027]

In the production of the bakery product of the present invention, the starchy raw material may contain a starchy raw material other than the waxy tapioca starch and the phosphate-cross-linked non-waxy starch. In such a case, a cereal such as wheat flour, whole wheat flour, bran, rye, rice, corn, barley, Japanese barnyard millet, foxtail millet, millet, sprouted brown rice, black rice, red rice, soybean, adzuki bean, amaranth, and quinoa can be contained according to the need, and wheat gluten or the like can be contained according to the need, in consideration of the type of the bakery product, etc. General wheat flour for use in bakery production can be used as the wheat flour. For example, extra strong flour, strong flour, all-purpose flour, or weak flour can be used. Typical examples thereof include: strong flour such as wheat flour produced from Canada Western Red Spring wheat; all-purpose flour such as wheat flour produced from Australian Standard White wheat; and weak flour such as wheat flour produced from Western White wheat and White Club wheat. Alternatively, wheat flour yielded in Japan (e.g., Yumehikara, Kitahonami, and Haruyo-Koi), low-amylose wheat flour, high-amylose wheat flour, waxy wheat flour, or the like may be used.

[0028]

The cereal as the starchy raw material other than the waxy tapioca starch and the phosphate-cross-linked non-waxy starch contained in the bakery product of the present invention is particularly preferably wheat flour, which can maximize the original flavor of the bakery product. Also, a starch other than the waxy tapioca starch and the phosphate-cross-linked non-waxy starch can be used in a range that produces the effects of the present invention, according to the need. For example, a resistant starch (RS) provided with resistance to human digestive enzymes by production using the starch other than the waxy tapioca starch and the phosphate-cross-linked non-waxy starch can also be used in consideration of health. The resistant starch is generally classified into four types called RS1, RS2, RS3, and RS4. RS1 refers to a starch that is physically inaccessible due to the trapping of its granules in the protein matrix. RS2 refers to a starch that can resist digestion by α -amylase. RS3 refers to a starch consisting of retrograded amylose. RS4 refers to a modified starch that can resist digestion by α -amylase.

[0029]

In the production of the bakery product of the present invention, the waxy tapioca starch and the phosphate-cross-linked non-waxy starch contained in the starchy raw material are contained at 1 part by mass or more and 20 parts by mass or less of the waxy tapioca starch and 1 part by mass or more and 20 parts by mass or less of the phosphate-cross-linked non-waxy starch with respect to 100 parts by mass of the starchy raw material

and can thereby confer favorable chewy texture and soft texture and reasonable slice aptitude to the bakery product. More preferably, the waxy tapioca starch and the phosphate-cross-linked non-waxy starch are contained at 5 parts by mass or more and 14 parts by mass or less and 3.5 parts by mass or more and 14 parts by mass or less, respectively, with respect to 100 parts by mass of the starchy raw material and can thereby achieve more favorable chewy texture and soft texture and more reasonable slice aptitude of the bakery product.

[0030]

Further, in the production of the bakery product of the present invention, the waxy tapioca starch contained in the starchy raw material is more preferably a hydroxypropyl waxy tapioca starch and/or an acetyl waxy tapioca starch. Use of such a starch produces a bakery product that has much better chewy texture and soft texture while maintaining reasonable slice aptitude. The hydroxypropyl waxy tapioca starch and/or the acetyl waxy tapioca starch may be lightly cross-linked. The lightly cross-linked starch refers to, for example, a starch treated by cross-linking such that a sedimentation volume reaches 9.5 or higher.

[0031]

In the production of the bakery product of the present invention, the phosphate-cross-linked non-waxy starch contained in the starchy raw material is more preferably a starch having a sedimentation volume of 9.4 or less. The sedimentation volume is more preferably 4.9 or less. Use of the phosphate-cross-linked non-waxy

starch having a sedimentation volume in this range produces a bakery product that is excellent in chewy texture, soft texture, and slice aptitude.

[0032]

In this context, the sedimentation volume is an index showing the progression of cross-linking. The sedimentation volume can be measured according to the following method: 0.15 g (in terms of dry content) of a starch is placed in a test tube and uniformly dispersed with 15 mL of a reagent (26% by weight of ammonium chloride, 10% by weight of zinc chloride, and 64% by weight of water). This dispersion is heated for 10 minutes in a boiling bath and then cooled to 25°C to 35°C. This starch solution is injected in a 10-mL graduated cylinder to a scale of 10 mL. This graduated cylinder is left standing at 25°C for 20 hours. The value of the scale of a precipitate is used as the sedimentation volume.

[0033]

In the production of the bakery product of the present invention, yeast, baking powder, common salt, water, and other secondary ingredients may be added, if necessary, in addition to the starchy raw material. Bakery dough is prepared on the basis of these raw materials according to a routine method and heat-treated by baking, frying, steaming, or the like to produce the bakery product of the present invention. At that time, the starchy raw material is contained at preferably 2 parts by mass or more to 40 parts by mass or less with respect to 100 parts by mass of the bakery product.

[0034]

In this context, the secondary ingredients refer to general secondary ingredients for use in bakery production or secondary ingredients for use depending on the type of a bakery, its desired quality, etc. Specific examples of the secondary ingredients can include: carbohydrates such as sugar, glucose, isomerized sugar, rare sugar, rare sugar-containing isomerized sugar (e.g., Rare Sugar Sweet, manufactured by Matsutani Chemical Industry Co., Ltd.), oligosaccharides, dextrin, and decomposition products of reduced starch; dairy products such as non-fat dry milk powder, whole milk powder, and Cow's milk; fats such as shortening, margarine, butter, powdered fat, and emulsified fat; emulsifiers such as glycerin fatty acid ester, sucrose fatty acid ester, and calcium stearoyl lactate; spices such as cinnamon and basil; liquors such as brandy and rum; dry fruits such as raisin and dry cherry; nuts such as almond and peanut; enzymes such as α -amylase, β -amylase, glucosidase, protease, lipase, xylanase, hemicellulase, and glucose oxidase; flavors such as vanilla essence; artificial sweeteners such as aspartame; dietary fibers such as pectin, guar gum decomposition products, agarose, glucomannan, polydextrose, sodium alginate, cellulose, hemicellulose, lignin, chitin, chitosan, resistant dextrin, and citrus fiber; and other ingredients such as cocoa powder.

[0035]

In the method for producing a bakery according to the present invention, the bakery production method itself does not differ in raw materials, production procedures, and production conditions from bakery production methods

known in the art except that a starchy raw material containing the waxy tapioca starch and the phosphate-cross-linked non-waxy starch are used as the starchy raw material. The starchy raw material of the present invention containing the waxy tapioca starch and the phosphate-cross-linked non-waxy starch can be prepared as a starchy raw material mix for bakery production. Alternatively, the starchy raw material of the present invention containing the waxy tapioca starch and the phosphate-cross-linked non-waxy starch may be combined with an enzyme and the like to prepare a quality improving agent in advance. This improving agent can also be added to dough for a bakery product to obtain the bakery product of the present invention. The starchy raw material containing the waxy tapioca starch and the phosphate-cross-linked non-waxy starch may be further used in a bakery production method called hot water-kneading-method, which involves preliminarily kneading a portion of dough with hot water. Also, the starchy raw material can be applied to refrigerated dough or frozen dough, which has been utilized in recent years for the purpose of rationalizing bakery food production steps or in light of distribution.

[0036]

Examples of the bakery product to which the method for producing a bakery product according to the present invention can be applied can include: breads such as "white breads including a Pullman bread and a white bread with a round top, a French bread including a baguette and a Parisien bread, and a sweet bun, a Danish pastry, a

crescent roll, a bun, a bagel, a naan, a focaccia, an English muffin, and various bread rolls including a table roll"; doughnuts such as "an yeast doughnut and a cake doughnut"; cakes such as "a steamed cake, a sponge cake, a butter cake, a pancake, a madeleine, and a muffin"; non-fermented breads such as "Biscoito de polvilho and Pao de queijo"; baked confectionery such as "pate a choux, a crape, a waffle, a Dorayaki (two small pancakes with bean jam in between), a castella (kasutera sponge cake), a Taiyaki (fish-shaped cake filled with red bean paste), a Imagawa-yaki (Japanese-style pancake filled with bean jam), and a cookie"; and other products such as a pizza, a tortilla, a Chinese dumpling, and a steamed bread. The method for producing a bakery product according to the present invention can confer reasonable slice aptitude to these products during secondary processing while conferring chewy texture and soft texture thereto. Particularly, the method for producing a bakery product according to the present invention is suitable for, for example, breads for use in sandwiches whose slice surfaces are easily noticeable.

[0037]

Hereinafter, the present invention will be described specifically with reference to Examples and Comparative Examples. However, the scope of the present invention is not limited by Examples below. In this context, "part" represents part by mass, and "%" represents % by mass. Starch without the term "pregelatinized" represents β starch.

Examples

[0038]

(Waxy tapioca starch)

The waxy tapioca starch used was waxy tapioca starch from Siam Quality Starch Co., Ltd. (Thailand). Modification treatment was performed by a routine method as shown in Table 1.

[0039]

[Table 1]

Modification	Sedimentation volume	Degree of substitution
Hydroxypropyl	-	0.10
Hydroxypropylated phosphate-cross-linked	9.9	0.10
Acetyl	-	0.07
Acetylated phosphate-cross-linked	9.8	0.07
Cross-linked	9.8	-
Pregelatinized Hydroxypropyl	-	0.10

[0040]

(Starch other than waxy tapioca starch)

Starches other than waxy tapioca starch were produced by preparing various starches and modifying the starches by routine method according to the need.

[0041]

(Texture evaluation of bakery product)

Each bakery product was prepared according to a routine method. The bakery product was evaluated for its chewy texture and soft texture upon eating. For use in the evaluation, the prepared bakery product was kept at 20°C for 1 hour to prepare a sample for evaluation. The sample was evaluated for the chewy texture and soft

texture of the bakery product by ten well-trained panelists on a scale of on which 5 is perfection for each item as shown in Table 2. Scores for the chewy texture and soft texture of a reference sample were each set to 3. Averages of the scores given by these ten panelists were determined and used as the evaluation scores of each sample. A bakery product produced using wheat flour alone was adopted as the reference sample. Samples having a score of 3.5 or higher were assessed as being good or better.

[0042]

The samples were assessed as being excellent, good, fair, or poor as follows according to the evaluation scores:

Excellent = 4.0 or higher

Good = 3.5 or higher and lower than 4.0

Fair = 3.0 or higher and lower than 3.5

Poor = Lower than 3.0

[0043]

[Table 2]

Score	Evaluation criteria
5	Very soft and very chewy
4	Soft and chewy
3	Slightly soft and chewy
2	Slightly less soft or slightly less chewy
1	Not soft or not chewy

[0044]

(Slice aptitude evaluation of bakery product)

The slice aptitude of each bakery product was evaluated by the measurement of stickiness to a creep

meter. The central portion of the prepared bread was cut into 40 mm square and 20 mm thick. The bread was compressed using a creep meter (RHEONER II CREEP METER RE-2-33005B, manufactured by Yamaden Co., Ltd.), and the stickiness of each sample was measured when releasing the bread from the creep meter. The measurement value was used as a guideline for adhesion to the blade of a slicer (slice aptitude). In this experiment, the bread surface of a bakery product having a stickiness of 35 J/m³ or more was confirmed to be roughened when sliced. As a result of conducting the stickiness test on currently commercially available breads, breads hardly having chewy texture (breads produced using wheat flour alone as a starchy raw material) had a stickiness of 6.2 J/m³, and the largest stickiness is 34.4 J/m³. Therefore, samples having a stickiness of 35 J/m³ or more were determined to have poor slice aptitude.

[0045]

The samples were assessed for their slice aptitude as being excellent, good, fair, or poor as follows according to the stickiness values:

Excellent = Less than 20 J/m³

Good = 20 J/m³ or more and less than 30 J/m³

Fair = 30 J/m³ or more and less than 35 J/m³

Poor = 35 J/m³ or more

[0046]

Creep meter measurement conditions were as follows:

Plunger: L50 + No. 2.

Compression rate: 5 mm/sec.

[0047]

Comprehensive evaluation adopted poorer evaluation results between texture evaluation and slice aptitude evaluation.

[0048]

(White bread test 1)

"Study on starch to be combined with waxy tapioca starch"

Each Pullman white bread was produced by the sponge method using wheat flour partially replaced with hydroxypropyl waxy tapioca starch alone or hydroxypropyl waxy tapioca starch combined with each starch (one starch selected from wheat starch, hydroxypropyl wheat starch, phosphate-cross-linked wheat starch, and phosphate-cross-linked waxy corn starch). The formula of ingredients is shown in Table 3. Starch B in Table 3 is as shown in Table 4.

[0049]

[Table 3]

Ingredient	Formula
Strong flour	85
Starch A (Hydroxypropyl waxy tapioca starch)	9.9
Starch B ^{*1}	3.3
Wheat gluten	1.8
Yeast food	0.1
Baker's yeast	2
Caster sugar	6
Common salt	2
Non-fat dry milk powder	2
Water	66
Shortening	5

*1: Starch B is the starch shown in Table 4.

[0050]

[Table 4]

	Starch B
Comparative Example 1	Hydroxypropyl waxy tapioca starch
Comparative Example 2	Wheat starch
Comparative Example 3	Hydroxypropyl wheat starch
Example 1	Phosphate-cross-linked wheat starch
Comparative Example 4	Phosphate-cross-linked waxy corn starch

[0051]

(Results of white bread test 1)

As shown in Table 5, the white bread obtained using the hydroxypropyl waxy tapioca starch alone did not have reasonable slice aptitude due to large stickiness. The white bread obtained using the hydroxypropyl waxy tapioca starch and the phosphate-cross-linked wheat starch in combination was excellent in chewy texture, soft texture, and slice aptitude.

[0052]

[Table 5]

Item	Comparative Example 1	Comparative Example 2	Comparative Example 3	Example 1	Comparative Example 4
Starch A	Po-WT	Po-WT	Po-WT	Po-WT	Po-WT
Starch B		Wheat starch	Hydroxypropyl wheat starch	Phosphate-cross-linked wheat starch	Phosphate-cross-linked waxy corn starch
Texture		4.4	4.3	4.2	4.5
Score		36.1	32	20.1	46.5
Evaluation	Texture	excellent	excellent	excellent	excellent
	slice aptitude	poor	poor	good	poor
	Comprehensive	poor	poor	good	poor

*1: Po-WT = Hydroxypropyl waxy tapioca starch

[0053]

(White bread test 2)

"Study on formula of waxy tapioca starch and phosphate-cross-linked non-waxy starch"

Each Pullman white bread was produced by the sponge method using wheat flour partially replaced with hydroxypropyl waxy tapioca starch and phosphate-cross-linked wheat starch in combination. The formula of ingredients is shown in Table 6.

[0054]

[Table 6]

Ingredient	Comparative Example 5	Comparative Example 6	Comparative Example 7	Example 2	Example 3	Example 4	Example 5	Example 6	Example 7	Example 8	Comparative Example 9	Comparative Example 10
Strong flour	98.3	72.7	96.6	95.5	74.4	85	85	70.5	74.4	55	64.8	50.1
Po-Wt	0.5	2	2.5	3	7.5	8.8	9.9	13	15	20	21	24
Phosphate-cross-linked wheat starch	1	22	0.5	1	15	4.4	3.3	13	7.5	20	10	20
Wheat gluten	0.2	3.3	0.4	0.5	3.1	1.8	1.8	3.5	3.1	5.0	4.2	6.0
Yeast food	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Baker's yeast	2	2	2	2	2	2	2	2	2	2	2	2
Caster sugar	6	6	6	6	6	6	6	6	6	6	6	6
Common salt	2	2	2	2	2	2	2	2	2	2	2	2
Non-fat dry milk powder	2	2	2	2	2	2	2	2	2	2	2	2
Water	66	66	66	66	66	66	66	66	66	66	66	66
Shortening	5	5	5	5	5	5	5	5	5	5	5	5

[0055]

(Evaluation results of white bread test 2)

As shown in Table 7, when the bakery product obtained using the hydroxypropyl waxy tapioca starch and the phosphate-cross-linked wheat starch in combination contained the hydroxypropyl waxy tapioca starch and the phosphate-cross-linked wheat starch in the ranges of 1 to 20 parts by mass and 1 to 20 parts by mass, respectively, with respect to 100 parts by mass of the starchy raw material, the obtained bakery product had chewy texture, soft texture, and reasonable slice aptitude. Also, when the hydroxypropyl waxy tapioca starch and the phosphate-cross-linked wheat starch were contained in the ranges of 5 to 14 parts by mass and 3.5 to 14 parts by mass, respectively, with respect to 100 parts by mass of the starchy raw material, the obtained bakery product had more favorable chewy texture and soft texture and excellent slice aptitude.

[0056]

[Table 7]

Ingredient	Comparative Example 5	Comparative Example 6	Comparative Example 7	Example 2	Example 3	Example 4	Example 5	Example 6	Example 7	Example 8	Comparative Example 8	Comparative Example 9	Comparative Example 10
PC-WT	0.5	2	2.5	3	7.5	8.8	9.9	13	15	20	20	21	24
Phosphate-cross-linked starch	1	22	0.5	1	15	4.4	3.3	13	7.5	20	0.3	10	20
Score	2.9	1.8	3.0	3.5	3.9	4.5	4.2	4.0	4.1	3.8	2.2	4.5	3.8
Stackiness	7	6.3	7.7	7.3	18.2	19.4	20.1	19.5	25.3	28.2	7.5	34.5	35
Texture	poor	poor	fair	good	good	excellent	excellent	excellent	excellent	good	poor	excellent	good
Slice aptitude	excellent	excellent	excellent	excellent	excellent	excellent	good	excellent	good	good	excellent	fair	poor
Comprehensiveness	poor	poor	fair	good	good	excellent	good	excellent	good	good	poor	fair	poor

[0057]

(White bread test 3)

"Study on phosphate-cross-linked non-waxy starch"

Each Pullman white bread was produced by the sponge method using wheat flour partially replaced with hydroxypropyl waxy tapioca starch and each phosphate-cross-linked starch in combination. The formula of ingredients is shown in Table 8. The phosphate-cross-linked starch used is phosphate-cross-linked wheat starch, phosphate-cross-linked potato starch, phosphate-cross-linked rice starch, or phosphate-cross-linked corn starch as shown in Table 9.

[0058]

[Table 8]

Ingredient	Formula
Strong flour	85
Po-WT	8.8
Phosphate-cross-linked starch	4.4
Yeast food	0.1
Baker's yeast	2
Wheat gluten	1.8
Caster sugar	6
Common salt	2
Non-fat dry milk powder	2
Water	66
Shortening	5

[0059]

[Table 9]

	Phosphate-cross-linked starch	
	Raw material	Sedimentation volume
Example 9	Wheat starch	9.4
Example 10	Wheat starch	1.7
Example 11	Wheat starch	0.5
Example 12	Potato starch	4.9
Example 13	Potato starch	0.8
Example 14	Rice starch	0.8
Example 15	Corn starch	5.2

[0060]

(Results of white bread test 3)

As shown in Table 10, the white bread obtained using the hydroxypropyl waxy tapioca starch and each phosphate-cross-linked starch in combination had chewy texture, soft texture, and reasonable slice aptitude. The preferred sedimentation volume of the phosphate-cross-linked starch was 9.4 or less. Particularly, when the sedimentation volume was 4.9 or less, the obtained white bread had more favorable chewy texture and soft texture and reasonable slice aptitude.

[0061]

[Table 10]

Item	Example 9	Example 10	Example 11	Example 12	Example 13	Example 14	Example 15
Phosphate-cross-linked starch	Wheat starch	Wheat starch	Wheat starch	Potato starch	Potato starch	Rice starch	Corn starch
Sedimentation volume	9.4	1.7	0.5	4.9	0.8	0.8	5.2
Texture	4.5	4.5	4.0	4.5	4.0	4.1	4.2
Stickiness	20.9	19.4	19.1	19.6	17.8	19.2	20.2
Texture	excellent	excellent	excellent	excellent	excellent	excellent	excellent
Slice aptitude	good	excellent	excellent	excellent	excellent	excellent	good
Comprehensive	good	excellent	excellent	excellent	excellent	excellent	good

[0062]

(White bread test 4)

"Study on waxy tapioca starch"

Each Pullman white bread was produced by the sponge method using wheat flour partially replaced with each waxy tapioca starch and phosphate-cross-linked wheat starch in combination. The formula of ingredients is shown in Table 11. When a non-pregelatinized starch was used as the waxy tapioca starch, formula 1 in Table 11 was utilized. When a pregelatinized starch was used, formula 2 in Table 11 was utilized. The waxy tapioca starch used is unmodified waxy tapioca starch, hydroxypropyl waxy tapioca starch, hydroxypropyl cross-linked waxy tapioca starch, acetyl waxy tapioca starch, acetyl cross-linked waxy tapioca starch, cross-linked waxy tapioca starch, or pregelatinized hydroxypropyl waxy tapioca starch as shown in Table 12.

[0063]

[Table 11]

Ingredient	Formula1 Examples 16-21	Formula2 Example 22
Strong flour	85	96.6
Waxy tapioca starch*	8.8	2
Phosphate-cross-linked wheat starch	4.4	1
Yeast food	0.1	0.1
Baker's yeast	2	2
Wheat gluten	1.8	0.4
Caster sugar	6	6
Common salt	2	2
Non-fat dry milk powder	2	2
Water	66	68
Shortening	5	5

*The waxy tapioca starch shown in Table 12 was utilized.

[0064]

[Table 12]

	Waxy tapioca starch	Abbreviation
Example 16	Not modified	Raw
Example 17	Hydroxypropyl	Po
Example 18	Hydroxypropyl cross-linked	Po-CL
Example 19	Acetyl	Ac
Example 20	Acetyl cross-linked	Ac-CL
Example 21	Cross-linked	CL
Example 22	Pregelatinized Hydroxypropyl	α -Po

[0065]

(Results of white bread test 4)

As shown in Table 13, the white bread obtained using the phosphate-cross-linked starch and the unmodified or each modified waxy tapioca starch as the waxy tapioca starch combined therewith was excellent in chewy texture, soft texture, and slice aptitude.

Particularly, use of the hydroxypropyl waxy tapioca starch, the acetyl waxy tapioca starch, or the waxy tapioca starch obtained by the cross-linking treatment of the hydroxypropyl waxy tapioca starch or the acetyl waxy tapioca starch produced more favorable effects.

Also, the white bread obtained using the pregelatinized hydroxypropyl waxy tapioca starch in combination with the phosphate-cross-linked starch was excellent in chewy texture, soft texture, and slice aptitude.

[0066]

[Table 13]

Item	Example 16	Example 17	Example 18	Example 19	Example 20	Example 21	Example 22
Waxy tapioca starch	Raw	Po	Po-CL	Ac	Ac-CL	CL	α -Po
Score	3.5	4.5	4.5	4.1	4	3.7	3.6
	16	19.8	19.4	18.7	17.5	16.4	10.5
Texture	good	excellent	excellent	excellent	excellent	good	good
Stickiness	excellent	excellent	excellent	excellent	excellent	excellent	excellent
Texture	good	excellent	excellent	excellent	excellent	good	good
Slice aptitude	excellent	excellent	excellent	excellent	excellent	excellent	excellent
Comprehensive	good	excellent	excellent	excellent	excellent	good	good

[0067]

(Hot dog bun test)

Each hot dog bun was produced by the sponge method using wheat flour partially replaced with hydroxypropyl waxy tapioca starch or hydroxypropyl waxy tapioca starch and phosphate-cross-linked wheat starch in combination. The formula of ingredients is shown in Table 14

[0068]

[Table 14]

Ingredient	Comparative Example 11	Example 23
Strong flour	85	85
Hydroxypropyl waxy tapioca starch	13.2	8.8
Phosphate-cross-linked wheat starch (sedimentation volume: 9.4)	-	4.4
Wheat gluten	1.8	1.8
Yeast food	0.1	0.1
Baker's yeast	4	4
Caster sugar	19	19
Common salt	2	2
Non-fat dry milk powder	2	2
Water	56	56
Whole egg	10	10
Margarine	10	10

[0069]

(Results of hot dog bun test)

The hot dog bun obtained using the hydroxypropyl waxy tapioca starch and the phosphate-cross-linked starch in combination was excellent in chewy texture, soft texture, and slice aptitude.

[0070]

(Sponge cake test)

Each sponge cake was produced by the all-in mix method using wheat flour partially replaced with hydroxypropyl waxy tapioca starch or hydroxypropyl waxy tapioca starch and phosphate-cross-linked wheat starch in combination. The formula of ingredients is shown in Table 15.

[0071]

[Table 15]

Ingredient	Comparative Example 12	Example 24
Weak flour	86.8	86.8
Hydroxypropyl waxy tapioca starch	13.2	8.8
Phosphate-cross-linked wheat starch (sedimentation volume: 9.4)	-	4.4
Caster sugar	120	120
Water	18	18
Whole egg	140	140
Emulsified fat	15	15

[0072]

(Results of sponge cake test)

The sponge cake obtained using the hydroxypropyl waxy tapioca starch and the phosphate-cross-linked starch in combination was excellent in chewy texture, soft texture, and slice aptitude.

Industrial Applicability

[0073]

The present invention provides a bakery product that is excellent in chewy texture and soft texture and also excellent in slice aptitude during bakery product processing. The method for producing a bakery product according to the present invention can be used in the

production of various bakery products and can be applied to the production of a wide range of bakery products to produce a bakery product that is excellent in chewy texture and soft texture and also excellent in slice aptitude during processing. Thus, the present invention eliminates losses during secondary processing (slicing) and enables supply of a commodity with high product value.

CLAIMS

1. A bakery product conferred with chewy texture, soft texture and slice aptitude, produced using a starchy raw material containing 1 to 20 parts by mass of a waxy tapioca starch and/or a modified waxy tapioca starch selected from a hydroxypropyl waxy tapioca starch, an acetyl waxy tapioca starch, and a waxy tapioca starch made by cross-linking the modified waxy tapioca starch, and 1 to 20 parts by mass of a phosphate-cross-linked non-waxy starch consisting of a phosphate-cross-linked starch having a sedimentation volume of 9.4 or less with respect to 100 parts by mass of the starchy raw material, in the starchy raw material used for the production of a bakery product.

2. The bakery product according to claim 1, wherein the bakery product is a bread, a cake, a doughnut, a baked confectionery, or a non-fermented bread.

3. A mix for bakery product production, containing 1 to 20 parts by mass of a waxy tapioca starch and/or a modified waxy tapioca starch selected from a hydroxypropyl waxy tapioca starch, an acetyl waxy tapioca starch, and a waxy tapioca starch made by cross-linking the modified waxy tapioca starch, and 1 to 20 parts by mass of a phosphate-cross-linked non-waxy starch consisting of a phosphate-cross-linked starch having a sedimentation volume of 9.4 or less with respect to 100 parts by mass of the starchy raw material, in the starchy raw material used for the production of a bakery product.

4. A method for producing a bakery product conferred with chewy texture, soft texture and slice aptitude, comprising using a mix for bakery product production containing 1 to 20 parts by mass of a waxy tapioca starch and/or a modified waxy tapioca starch selected from a hydroxypropyl waxy tapioca starch, an acetyl waxy tapioca starch, and a waxy tapioca starch made by cross-linking the modified waxy tapioca starch, and 1 to 20 parts by mass of a phosphate-cross-linked non-waxy starch consisting of a phosphate-cross-linked starch having a sedimentation volume of 9.4 or less with respect to 100 parts by mass of the starchy raw material, as a starchy raw material.