

A TARO-BASED FILLED-DOUGH PRODUCT

BACKGROUND

[0001] Filled-dough products such as Tangyuan have been and continue to be a popular dessert item amongst Chinese-speaking communities. For example, Tangyuan is often consumed during the annual Lantern Festival and Chinese New Year and is commonly seen on dessert menus of Chinese restaurants. Filled-dough products can be made sweet or salty and served hot or cold, depending on the dessert dish. Filled-dough products such as Tangyuan are often made by enclosing a filling with a glutinous rice four-based wrapping that is soft once fully cooked and hydrolyzed (e.g., by being cooked in boiling water). Owing to the relatively fragile and glutinous rice flour-based wrapping and low modifiability, variety in flavor and aroma is typically achieved by modifying the filling of the filled-dough products. To enrich the consumption experience of filled-dough products, the present disclosure describes a taro-based filled-dough product including a versatile wrapping which has an attractive aroma, springy mouthfeel, enhanced dietary fiber content and improved digestibility.

SUMMARY

[0002] The present disclosure relates to a filled-dough product such as a taro-based filled-dough product.

[0003] In some embodiments, a filled-dough product includes a filling and a dough wrapping enclosing the filling. The dough wrapping has a dough composition including taro and optionally a starch-rich tuber (e.g., an edible root) together on a dry basis in an amount from 4% to 6% by weight of the dough composition. In various examples, the dough composition further includes tapioca starch in an amount from 15% to 25% by weight of the dough composition, waxy maize starch in an amount from 25% to 35% by weight of the dough composition, pregelatinized hydroxypropyl distarch phosphate in an amount from 1% to 3% by weight of the dough composition, and water in an amount of up to 55% by weight of the dough composition.

[0004] While multiple embodiments are disclosed, still other embodiments of the present invention will become apparent to those skilled in the art from the following detailed description, which shows and describes illustrative embodiments of the invention.

Accordingly, the drawings and detailed description are to be regarded as illustrative in nature and not restrictive.

DETAILED DESCRIPTION

[0005] Filled-dough products such as Tangyuan are a popular food item. To enrich the consumption experience of filled-dough products, the present disclosure describes a taro-based filled-dough product including a versatile dough wrapper or wrapping which may have an attractive aroma, springy mouthfeel, enhanced dietary fiber content and/or improved digestibility as compared to filled-dough product with a rice flour-based dough wrapper. According to some embodiments, a filled-dough product includes a filling and a dough wrapping enclosing the filling. As described herein, a filled-dough product may be formed by forming the dough wrapping having a dough composition around the filling and subsequently cooking the filled-dough product, for example by boiling. In some examples, the filling includes sesame, red bean, peanut, purple potato, and/or pork. In various embodiments, the dough wrapping has a dough composition including taro, tapioca starch, waxy maize starch, and water. Optionally, the dough wrapping may include one or more starch-rich tubers, high fructose syrup, fat, and/or edible gums. In certain examples, glutinous rice flour may be included in the dough composition additionally or alternatively.

[0006] Taro is a root vegetable and the common name for the edible corms or bulbotubers of the tropical plant *colocasia esculenta*. In various examples, the dough wrapping may be formed by using taro that is directly sourced or produced via peeling, cleaning, cooking (e.g., steaming, boiling, baking, and/or roasting), mashing, optionally filtering, and optionally seasoning. Taro may also be added to the dough wrapping as a prepared paste or powder form. The taro powder can be sourced or produced as powder of cooked powder. For example, to form the powder, water may be removed from cooked taro to achieve a dry product (e.g., a dry product with up to 10% in water content). The water content of taro will vary depending on the form of taro used. For example, directly sourced (i.e., steamed and mashed) taro will generally have a higher water content than taro in paste form. Similarly, taro in paste form will generally have a higher water content than taro in powder form.

[0007] In some embodiments, the dough wrapping may also include one or more starch-rich tuber, such as sweet potato, purple potato, potato, yam, or pumpkin. The starch-

rich tubers may be added to the wrapper dough as a directly sourced ingredient, a paste or a powder, as described herein.

[0008] The incorporation of taro and/or the starch-rich tuber provides aroma, taste, and mouthfeel (e.g., texture) to the wrapping that are uniquely different from the traditional rice flour-based wrapping. In comparison to traditional rice flour-based wrapping, the dough wrapper has increased dietary fiber content and improved digestibility. These benefits are due, at least in part, to the presence of taro and optionally the one or more starch-rich tubers. Additionally, the color of the dough wrapper can be adjusted by the taro content and the starch-rich tuber content naturally without coloring agent. For example, a dough wrapping including taro can be gray and/or light purple, a dough wrapping including a combination of taro and sweet potato or pumpkin can be orange and/or yellow, a wrapping including a combination of taro and purple potato can be deep purple, and a dough wrapping including a combination of taro and potato or yam (e.g., Chinese yam/shanyao) can be white and/or light yellow. In contrast, most rice flour-based wrappings of traditional Tangyuans are white or gray.

[0009] In certain examples, the dough composition of the dough wrapping includes taro and optionally one or more starch-rich tubers together on a dry basis in an amount from 4% to 6% by weight of the dough composition. For example, 4% to 6% taro in powder form by weight to the dough composition may be used. In certain embodiments, the dough composition of the dough wrapping includes taro and optionally the one or more starch-rich tubers together in paste form on a wet basis in an amount from 15% to 20% by weight of the dough composition. In paste form, the taro and/or the starch-rich tuber can include water content between 70% to 90%, such as between 75% to 85%, or such as between 79% to 82% by weight. In certain examples, the taro and/or the starch-rich tuber (e.g., as paste) on a wet basis may be transformed into a dry basis (e.g., as powder) by removing the water content. In some embodiments, the taro and/or the starch-rich tuber on a dry basis may include water content up to 10%.

[0010] The dough wrapper also includes tapioca starch. In various embodiments, the tapioca starch content is controlled, tuned, modified, or selected according to a target springiness index of the wrapping as measured after cooking and fully hydrolyzed. For

example, a target springiness index is between 0.2 and 0.4, 0.25 and 0.35, or 0.25 and 0.31. It has been found that increasing the tapioca starch content increases the springiness index of the cooked and hydrolyzed dough wrapping. In some examples, the tapioca starch can tune or adjust the translucency of the cooked and hydrolyzed dough wrapping. In some embodiments, it has been found that decreasing the tapioca starch content of the dough composition reduces the opacity of the cooked and hydrolyzed dough wrapping. In certain examples, the dough composition includes tapioca starch in an amount from 15% to 25% by weight of the dough composition. .

[0011]

[0012] The dough composition further includes waxy maize starch, which may also be referred to as waxy corn starch. In certain embodiments, the waxy maize starch content is selected to help control the mouthfeel, such as consistency, softness, springiness, and/or texture, of the cooked and hydrolyzed dough wrapping. For example, it has been found in some embodiments increasing the waxy maize starch content produces a softer and/or more deformable wrapping. In some embodiments, the waxy maize starch may be adjusted based on characteristics of the filling, such as consistency, softness, texture), of the filled-dough product. For example, a filled-dough product with a soft filling may be paired with a dough wrapping having a higher waxy maize starch content, and thus a softer texture. The waxy maize starch can delay aging of cooked wrapping, such as delay moisture-loss below a certain threshold, which can help improve the tasting experience especially during cold-consumption. In certain examples, the dough composition includes waxy maize starch in an amount from 25% to 35% by weight of the dough composition. In certain embodiments, the dough composition may include waxy maize starch in an amount of greater than 25% and up to 35% by weight of the dough composition. In certain examples, glutinous rice flour may be used alternatively or additionally to waxy maize starch for substantially the same purpose. The dough composition further includes pregelatinized hydroxypropyl distarch phosphate. In some examples, the pregelatinized hydroxypropyl distarch phosphate is added as a chemically-modified corn starch. The pregelatinized hydroxypropyl distarch phosphate can serve as a thickener. In various examples, the pregelatinized hydroxypropyl distarch phosphate content is selected to help tune the mouthfeel, such as consistency, softness,

springiness, and/or texture, of the cooked and hydrolyzed dough wrapping. For example, in some embodiments it has been found that increasing the pregelatinized hydroxypropyl distarch phosphate content of the dough wrapper produces a softer dough wrapper following cooking. In some embodiments, the pregelatinized hydroxypropyl distarch phosphate in the dough wrapper improves the dough's water-retaining ability. That is, the pregelatinized hydroxypropyl distarch phosphate may reduce water loss via phase separation and/or evaporation. The improved water-retaining ability can widen the workable range of water content in the dough composition and reduces production instability and/or inconsistency caused by water loss such as from the dough surface. In some embodiments, the improved water-retaining ability of the dough eliminates the need of process steps for re-balancing water content during the filled-dough products. In certain examples, the addition of pregelatinized hydroxypropyl distarch phosphate reduces stickiness of the dough surface, which improves the industrial dough production process. In some embodiments, the dough composition includes pregelatinized hydroxypropyl distarch phosphate in an amount from 1% to 3% by weight of the dough composition. In various embodiments, the inclusion of pregelatinized hydroxypropyl distarch phosphate can improve the dough's stability in the frozen state as well as the dough's resistant in defect-formation (e.g., point, line, or areal defects) during a quick-freezing process and/or a quick-thawing process. Such improved stability can help with transportation and storage of the filled-dough products. The addition of pregelatinized hydroxypropyl distarch phosphate can extend the product's shelf-life.

[0013] The dough composition also includes water in an amount of up to 55% by weight of the dough composition. Water may be independently added or may be added as moisture in an ingredient. For example, when taro and/or starch-rich tuber are provided in powder form, water in an amount from 25% to 55% by weight of the dough composition may be independently added to the dough. In another example when taro and/or starch-rich tubers are provided in paste form, water in an amount from 10% to 40% by weight of the dough composition may be independently added to the dough. In certain examples, the water is deionized water or distilled water.

[0014] Optionally, the dough composition of the dough wrapping can include high fructose syrup in an amount greater than 0% and less than or equal to 10% by weight of the

dough composition. The high fructose syrup can be substituted fully or partially by another sweetening agent. The addition of high fructose syrup increases sweetness and help brings out the aroma of the taro and/or the starch-rich tuber. The high fructose syrup can also help bring out the aroma of the taro and/or starch-rich tuber, and to improve water-retention to help reduce surface cracking of the wrapping, especially during production.

[0015] The dough composition may optionally include one or more fat sources, such as margarine, corn oil, peanut oil, sunflower seed oil, canola oil, olive oil, sesame oil, and/or grapeseed oil, in an amount greater than 0% and less than or equal to 5% by weight of the dough composition. The fat increases the ductility of the dough and/or reduces the stickiness of the dough surface such that the dough can be processed through the industrial processing machine more smoothly and consistently.

[0016] The dough composition may optionally include one or more edible gums. Suitable edible gums include xanthan gum, guar gum and combinations thereof. In some examples, edible gums may be included to improve the surface (e.g. smoothness) of the wrapping (e.g., after boiling) and/or reduce water loss during the cooking process. For example, the dough composition may include edible gums in an amount greater than 0% and less than or equal to 1% by weight of the dough composition.

[0017] Exemplary dough compositions of the dough used to produce the wrapping of the filled-dough product are provided in Table 1. All components in Table 1 are provided as weight percent of the dough composition. In particular, Formula A is an exemplary dough composition in which the taro and optional one or more starch-rich tubers are provided in paste form, and Formula B is an exemplary dough composition in which the taro and optional one or more starch-rich tubers are provided in powder form.

Table 1: Wrapping dough compositions

Ingredients	Formula A (wt%)	Formula B (wt%)
Taro + Starch-Rich Tuber Paste	15-20	-
Taro + Starch-Rich Tuber Powder	-	4-6
Tapioca Starch	15-25	15-25
Pregelatinized Hydroxypropyl distarch phosphate	1-3	1-3

Waxy Maize Starch	25-35	25-35
High Fructose Syrup	0-10	0-10
Fat (e.g., Margarine)	0-5	0-5
Edible Gums	0-1	0-1
Water	10-44	25-55

[0018] The amylose contents of the doughs in Table 1 are provided in Table 2. The amylose contents of the doughs in Table 2 are provided as weight percent of the starch basis, which includes taro, tapioca starch, waxy maize starch, and the optional starch-rich tuber(s). In certain embodiments, an amylose content between 4% to 7% help provides the desired mouthfeel of the wrapping.

Table 2: Amylose content in wrapping dough

Samples	Amylose content (wt% of the starch basis)
Formula A	4.0-6.5
Formula B	4.5-7.0

[0019] For comparison, the surface adhesiveness of the wrapping dough in accordance of the present disclosure (i.e., Formula A and Formula B) is measured and contrasted with a wrapping dough of a rice flour-based wrapping of traditional Tangyuan. The surface adhesiveness corresponds to the stickiness of the dough surface, which is a critical property influencing the dough's ease of manufacturability, in particularly using industrial production processes. The surface adhesiveness results are presented in Table 3. The samples tested in Table 3 are prepared by making a dough disc (e.g., of about 25 mm in radius and 3 mm in thickness), boiling the dough disc (e.g., in 1000 ml of boiling water in medium heat till the dough disc floats and followed by 3 min of boiling in low heat), and cooling down (e.g., in room temperature for 5 min while being covered with protective wrap, such as plastic protective wrap). The samples were then tested with a P/25P probe at 40% strain, 5 sec of test period, 2 mm/s of pre-test speed, 1 mm/s of test speed, 1 mm/s of post-test speed, and 5 g of trigger force. In some examples, multiple discs are tested for each of the samples.

Table 3: Surface adhesiveness of wrapping dough

Samples	Surface adhesiveness	
	Force (g/mm ²)	Work (g s/mm ²)
Rice Tangyuan Dough	2.4	4.0
Formula A	2.8	4.2
Formula B	2.1	3.3

[0020] According to the Table 3, the wrapping dough using taro and/or starch-rich tuber paste (i.e., Formula A) has a higher surface adhesiveness (e.g., stickier) than the traditional rice Tangyuan dough; whereas the wrapping dough using taro and/or starch-rich tuber powder (i.e., Formula B) has a lower surface adhesiveness (e.g., less sticky) than the traditional rice Tangyuan dough. In some embodiments powdered flour can be added onto the external surface of the filled-dough products to reduce surface adhesiveness.

[0021] For comparison, the hardness, cohesiveness, and springiness of the wrapping dough in accordance of the present disclosure (i.e., Formula A and Formula B) are measured and contrasted with a wrapping dough of a rice flour-based wrapping of traditional Tangyuan. The results are presented in Table 4. In certain examples, the samples of Table 4 are prepared the same way as the samples of Table 3. In some examples, multiple discs are tested for each of the samples.

Table 4: Thickness, hardness, cohesiveness, springiness of wrapping dough after boiling

Samples	Thickness (mm)	Hardness (g)	Cohesiveness index	Springiness index
Rice Tangyuan	3	135.1	0.36	0.23
Formula A	3	194.2	0.47	0.30
Formula B	3	208.5	0.52	0.32

[0022] According to Table 4, the wrapping dough samples tested have a common thickness of 3 mm. The wrapping dough using taro and/or starch-rich tuber powder (i.e., Formula B) has a higher hardness, cohesiveness index, and springiness index than the wrapping dough using taro and/or starch-rich tuber paste (i.e., Formula A), which has a higher hardness, cohesiveness index, and springiness than the traditional rice Tangyuan dough wrapping. Hardness is measured as the force leading to 40% deformation. The cohesiveness index reflects the degree of recovery from after removing a deformation force applied to the samples. Springiness is measured using a texture profile analysis equipment.

[0023] In various examples, the dough composition of the dough wrapping optionally includes a pH-modifier. In some examples, the pH-modifier is added to tune the viscosity, yielding behavior (e.g., yield stress), porosity, hardness, texture and/or the stickiness of the dough. In addition to or in place of the pH-modifier, an ionic strength-modifier can be added to achieve the same. For example, pH-modifier can be added to avoid pH near the extremes (e.g., near 1 or 14) and ionic strength-modifier can be added to avoid high ionic strength. At extreme pH and/or high ionic strength, certain ingredients, such as the hydrogels tapioca starch of the dough composition may become less capable of being hydrolyzed, which may lead to a hardened mouthfeel and reduced springiness.

[0024] In some embodiments, the pregelatinized hydroxypropyl distarch phosphate, fat, and/or edible gums may improve ductility of the dough wrapping and thus improve ease with which the dough wrapper may be formed around the filling of the filled-dough products. For example, a more ductile dough wrapping may result in a better filled-dough product, including a product having the filling positioned at the center of the filled-dough product, a dough wrapping that is thin and/or has a consistent thickness, and/or has a seamless or near seamless enclosure for a smooth exterior dough surface.

[0025] In some examples, the filled-dough products described herein can be produced using traditional methods for Tangyuan production. For example, the filled-dough products can be formed by hand, using production machines or a combination thereof. In some examples, the filled-dough products produced using traditional Tangyuan production machines are substantially spherical and are frozen after production. The filled-dough products may then be packaged and transported to a distributor or end consumer. To use the

filled-dough products, the products may be thawed, cooked, such as by boiling, and consumed. In various embodiments, the dough composition of the dough wrapping further includes hydroxypropyl tapioca starch. The inclusion of hydroxypropyl tapioca starch can improve the dough's stability in the frozen state as well as the dough's resistant in defect-formation (e.g., point, line, or areal defects) during a quick-freezing process and/or a quick-thawing process. Such improved stability can help with transportation and storage of the filled-dough products. The addition of hydroxypropyl tapioca starch can also extend the filled-dough product's shelf-life.

[0026] Various modifications and additions can be made to the exemplary embodiments discussed without departing from the scope of the present invention. For example, while the embodiments described above refer to particular features, the scope of this invention also includes embodiments having different combinations of features and embodiments that do not include all of the above described features.

CLAIMS

The following is claimed:

1. A filled-dough product comprising:
 - a filling; and
 - a dough wrapping enclosing the filling and having a dough composition including:
 - taro and optionally a starch-rich tuber together on a dry basis in an amount from 4% to 6% by weight of the dough composition;
 - tapioca starch in an amount from 15% to 25% by weight of the dough composition;
 - pregelatinized hydroxypropyl distarch phosphate in an amount from 1% to 3% by weight of the dough composition;
 - waxy maize starch in an amount from 25% to 35% by weight of the dough composition; and
 - water in an amount of up to 55% by weight of the dough composition.
2. The filled-dough product of claim 1, wherein the starch-rich tuber is one selected from the group consisting of sweet potato, purple potato, yam, pumpkin.
3. The filled-dough product of claim 1, wherein the taro, the optional starch-rich tuber, tapioca starch, and waxy maize starch forms a starch basis including amylose content of 4% to 7% by weight.
4. The filled-dough product of claim 1, wherein the dough wrapping, once cooked and hydrolyzed, has a cohesiveness index of 0.47 to 0.52.

5. The filled-dough product of claim 1, wherein the dough wrapping, once cooked and hydrolyzed, has a springiness index of 0.30 to 0.32.

6. The filled-dough product of claim 1, wherein a thickness of the wrapping is 3 mm.

7. The filled-dough product of claim 1, wherein the dough composition further includes a pH-modifier.

8. The filled-dough product of claim 1, wherein the dough composition further includes an ionic strength-modifier.

9. The filled-dough product of claim 1, wherein the dough composition further includes high fructose syrup greater than 0% and less than or equal to 10% by weight of the dough composition.

10. The filled-dough product of claim 1, wherein the dough composition further includes fat greater than 0% and less than or equal to 5% by weight of the dough composition.