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(57) **Abrégé/Abstract:**

Ready-to-eat food bar consisting of agglomerated particles and/or flakes of one or more cooked-extruded bases mainly comprising amylaceous materials and milk solids which are coated with a binder mainly comprising sugar, milk solids and a binding agent.



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<p>(21) International Application Number: PCT/EP00/01754 (22) International Filing Date: 2 March 2000 (02.03.00) (30) Priority Data: 99200914.2 24 March 1999 (24.03.99) EP 99201125.4 13 April 1999 (13.04.99) EP (71) Applicant (for all designated States except US): SOCIETE DES PRODUITS NESTLE S.A. [CH/CH]; P.O. Box 353, CH-1800 Vevey (CH). (72) Inventors; and (75) Inventors/Applicants (for US only): BURRI, Josef [CH/CH]; 25, chemin de la Pierraz, CH-1066 Epalinges (CH). DAENZER-ALLONCLE, Martine [CH/CH]; 10, Les Aubiers, CH-1436 Treycovagnes (CH). DESJARDINS, Jean-Jacques [FR/CH]; Chemin du Signal, CH-1137 Yens (CH). NEIDLINGER, Sylke [DE/CH]; 12, chemin de Chantemerle, CH-1010 Lausanne (CH). (74) Agent: WAVRE, Claude-Alain; 55, avenue Nestlé, CH-1800 Vevey (CH).</p>	<p>(81) Designated States: AE, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CR, CU, CZ, DE, DK, DM, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZW, ARIPO patent (GH, GM, KE, LS, MW, SD, SL, SZ, TZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).</p> <p><b>Published</b> <i>With international search report. Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.</i></p>	
<p>(54) Title: CEREAL BAR</p>		
<p>(57) Abstract</p> <p>Ready-to-eat food bar consisting of agglomerated particles and/or flakes of one or more cooked-extruded bases mainly comprising amylaceous materials and milk solids which are coated with a binder mainly comprising sugar, milk solids and a binding agent.</p>		

## CEREAL BAR

The present invention relates to a ready-to-eat food bar and to a process for manufacturing it.

5

**The state of the art**

US4650685 (Persson et al.) discloses a biscuit comprising agglomerated granules of a cooked-extruded base coated with a binder, the base comprising from 40 to 80 parts by weight of cereal flour, up to 20 parts sucrose and from 0.5 to 3 parts of oil or fat, and the binder comprising from 8 to 30 parts by weight of sucrose and/or mixtures of glucose and its polymers.

15

WO89/04121 (HEINZ SCHAAF OHG) discloses a process for manufacturing cereals by cooking-extruding a mixture of cereal material, vegetable and/or fruits with a partial amount of sugar and milk, cutting the expanded rope of cooked-extruded mixture into pieces having a large surface, spraying an aqueous suspension of sugar and milk onto the just cut, hot and moist pieces, coating the moistened pieces with a remaining part of components in powder form and drying the coated pieces.

20

**The objects of the invention**

A first object of the present invention is to provide a ready-to-eat food bar mainly comprising amylaceous material, sugar and milk solids, which is nutritionally valuable and which may represent a complete meal just as it is.

30

A second object of the present invention is to provide a process for manufacturing such a ready-to-eat food bar.

35

**The invention**

To this end, the present ready-to-eat food bar consists of agglomerated particles and/or flakes of one or more cooked-extruded bases mainly comprising amylaceous materials and milk solids which are coated with a binder mainly comprising sugar, milk solids and a binding agent.

The present process for manufacturing a ready-to-eat food bar consists of preparing a dry mixture of particles and/or flakes of one or more cooked-extruded bases mainly comprising amylaceous materials and milk solids, mixing the dry mixture with a binder mainly comprising sugar, milk solids and a binding agent, and forming the mass thus obtained into a bar shape.

**General description of the food bar**

In the present context, the expression "being nutritionally valuable" may be understood as designating a food bar based on amylaceous materials and sugar especially comprising, in % by weight, from 5.5 to 27.5% of milk solids non fat and from 2.5 to 12.5% of milk fat and/or vegetable fat, that means a food bar based on amylaceous materials and sugar which is rich in milk protein and calcium.

However, as a whole, beside a few percent of each of residual water, ash, dietary fibers and binding agent, the present food bar may generally comprise, in % by weight, from about 6 to 18% of protein, from about 60 to 80% of available carbohydrate and from about 2.5 to 15% of fat, for example.

It has surprisingly been found that it was possible in this way to provide a food bar which is ready-to-eat, namely ready to be eaten by scrunching it just as it is, while

being nutritionally valuable and especially comprising  
amylaceous materials, sugar, milk solids and calcium.

5 It has been found that the milk solids may better be  
incorporated into the food bar in two parts, a first part  
being incorporated into the cooked-extruded bases and a  
second part being incorporated into the binder.

10 It has also been found that with a preferred high content  
of milk solids, namely of from more than 16% of whole milk  
solids, which means from more than about 11% milk solids  
non fat and from more than about 5% milk fat, it is still  
possible to obtain cooked-extruded-expanded bases which  
15 have a fine, porous, crunchy, smooth, melt-in-the-mouth and  
not hard texture.

The present food bar may comprise from 5.5 to 27.5%,  
preferably from more than 11 to 22% and more preferably  
from more than 11 to 27.5% of milk solids non fat, from 2.5  
20 to 12.5%, preferably from more than 5 to 10% and more  
preferably from more than 5 to 12.5% of milk fat and/or  
vegetable fat, from 30 to 60% of amylaceous material, from  
5 to 30% of sugar, from 0.2 to 1.5% of binding agent and  
from 1.0 to 8.0%, preferably from 1.0 to 4.0% of residual  
25 water.

The present food bar may further comprise up to 3% of  
additional calcium, preferably in form of calcium  
carbonate, in addition to the calcium already present in  
30 the milk solids non fat, for example.

The food bar may also further comprise, added vitamins,  
oligoelements and sodium chloride and/or a source of  
dietary fibers, for example.

35

The milk solids non fat in the cooked-extruded bases may be powdered skimmed milk, for example.

5 The milk fat and/or vegetable fat in the cooked-extruded bases may be butter oil and/or vegetable oil or fat which may act as lubricating agent in the cooking-extruding process, for example.

10 The milk solids in the binder may be whole milk powder, for example.

The amylaceous material may be a cereal flour, a starch and/or maltodextrin, for example.

15 The cereal flour may be wheat, barley, oat, rice and/or corn, for example.

20 The starch may be a native starch from wheat, barley, rice, tapioca, potato and/or corn, especially waxy corn, for example.

The sugar may be sucrose, dextrose and/or fructose, for example.

25 Beside sugar, milk solids and a binding agent, the binder may further comprise glycerin, for example.

The binding agent may be a polysaccharide or a gum such as gum-arabic, for example.

30 The source of dietary fibers may be a cereal bran, for example.

35 A preferred embodiment of the present ready-to-eat food bar consists of agglomerated particles and/or flakes of different bases mainly comprising different cereals beside

milk solids, especially a cooked-extruded-expanded base  
mainly comprising rice flour, a cooked-extruded-expanded  
base mainly comprising wheat flour and wheat starch, and/or  
a cooked-extruded and flaked base mainly comprising corn  
5 flour and corn starch.

The present product has the shape of a bar, especially a  
bar having a rectangular, oval or circular cross section,  
for example. It preferably has a chewy texture.

10

#### **General description of the process for manufacturing the food bar**

As stated above, the present process for manufacturing a  
15 ready-to-eat food bar consists of preparing a dry mixture  
of particles and/or flakes of one or more cooked-extruded  
bases mainly comprising amylaceous materials and milk  
solids, mixing the dry mixture with a binder mainly  
comprising sugar, milk solids and a binding agent, and  
20 forming the mass thus obtained into a bar shape.

#### Preparing particles of a cooked-extruded-expanded base

25 Particles of a cooked-extruded-expanded base mainly  
comprising amylaceous materials and milk solids may be  
obtained by cooking-extruding-expanding at 120 to 170°C  
under 40 to 160 bar for 5 to 50 s a mixture comprising, in  
parts by weight, from 5.5 to 27.5 parts, preferably from  
more than 11 to 22 parts and more preferably from more than  
30 11 to 27.5 parts of milk solids non fat, from 2.5 to 12.5  
parts, preferably from more than 5 to 10 parts and more  
preferably from more than 5 to 12.5 parts of milk fat  
and/or vegetable fat, from 50 to 80 parts of amylaceous  
material, up to 12 parts of sugar, and added water up to a  
35 water content of from 11 to 19% by weight of the mixture,  
such a water content being adequate for obtaining a correct

expansion after cooking-extruding the mixture, thus obtaining a rope of a thermo plastic mass having a porous texture, cutting the rope into pieces and optionally drying them down to a residual water content of from 1.0 to 4.0%.

5

The mixture may further comprise up to 3 parts of additional calcium, preferably in form of calcium carbonate, in addition to the calcium already present in the milk solids non fat, for example.

10

The mixture may also further comprise added vitamins, oligoelements and sodium chloride, for example.

15

The mixture may be prepared by first mixing together powdery components to obtain a dry mix and then mixing together the dry mix and liquid or fluid components.

20

This mixing step may be carried out in a first mixing section of a traditional food extruder, especially a twin screw extruder, for example.

25

Cooking the mixture may then be carried out in subsequent sections of the extruder where the mixture is heated, compressed and sheared so that it forms a cooked thermo plastic mass.

30

The thermo plastic mass may be extruded by having it pushed by the extruder screw or twin screw through the openings of a die provided for at an end of the extruder.

35

The die may have one or more circular openings having of from 2 to 5 mm in diameter, for example.

The thermo plastic mass may be expanded by extruding it through the die into an open space at ambient temperature and at atmospheric pressure, for example.

Water is lost in form of steam escaping the thermoplastic mass during expansion so that the rope thus obtained has a porous texture and may have a water content of from 5 to less than 11%, for example.

Compressed nitrogen may be injected into the plastified mass just before extruding it. Nitrogen injection may be carried out under a pressure of from about 35 to 160 bar, at a rate of from 0.1 to 0.6 g nitrogen per kg of mass, for example.

Most surprisingly, the cooked-extruded thermoplastic mass does not expand to a greater degree under the effect of nitrogen injection but on the contrary to a lesser degree. This is because the injected nitrogen not only increases the number of bubbles within the expanded rope of cooked-extruded thermoplastic mass but also cools down the mass before it is extruded. A fine porous texture may be obtained in this way which stands in contrast with a rather coarse porous texture which may be obtained without nitrogen injection.

Cutting into pieces the thus obtained rope of expanded thermoplastic mass may be carried out by a two or more blade cutter rotating adjacent to the die openings, for example.

Drying the pieces, preferably down to a residual water content of from 1.0 to 4.0% by weight, may be carried out on a belt dryer with hot air, for example.

#### Preparing flakes of a cooked-extruded base

Flakes of a cooked-extruded base mainly comprising amylose materials and milk solids may be obtained in a

way similar to the way disclosed above for particles of a  
cooked-extruded-expanded base except that the mixture to be  
cooked-extruded comprises added water up to a water content  
of from 20 to 30% (instead of from 11 to 19%) by weight of  
5 the mixture, such a water content being adequate for  
obtaining no or only little expansion after cooking-  
extruding the mixture.

10 Cutting into pieces the thus obtained rope of non or only  
slightly expanded thermoplastic mass may be carried out by  
a two or more blade cutter rotating adjacent to the die  
openings, for example.

15 The pieces of cooked-extruded base thus obtained may then  
be flaked between a pair of rollers and dried down to a  
residual water content of from 1.0 to 4.0% by weight, for  
example.

#### Preparing the binder

20

The binder may be prepared by mixing together its  
components.

25 An adequate binder may have a milk solids content which is  
lower, similar to or even more important than the milk  
solids content of the particles and/or flakes of cooked-  
extruded bases, but not higher than about 40% on dry  
matter, for example.

30 The possible milk solids may be incorporated into the  
binder in form of fresh milk and/or of milk powder, for  
example.

35 Water may be added as such or as water contained in fresh  
milk, for example.

The binder may comprise, in parts by weight, from 10 to 70 parts of sugar, from 0.5 to 5 parts of binding agent, up to 40 parts of whole milk solids, up to 15 parts of glycerin, up to 60 parts of fruit pulp or concentrate, up to 10 parts of cocoa powder and added water up to a water content of from 10 to 30%, for example.

#### Mixing particles and/or flakes and binder

10 A dry mix of particles and/or flakes is first prepared.

Mixing the dry mix with the binder may be carried out by means of any adequate mixing apparatus such as a screw mixer of the helical spring type with an axial sprinkling nozzle or with a coating drum, for example.

The dry mix and the binder may be mixed at a rate of about 40 to 70 parts by weight of dry mix and about 60 to 30 parts by weight of binder, for example.

20 A fat, especially an aromatic vegetable fat such as coconut fat may be added at this stage at a rate of from about 2.5 to 5 parts, for example.

#### 25 Shaping the bar and optionally drying

The mass obtained by mixing particles and/or flakes with the binder may be formed into a bar shape by extrusion through a die having a rectangular, oval or circular opening or by moulding, for example.

The ready-to-eat food bar thus obtained may then be dried down to a residual water content of 1.0 to 4.0%, on a belt dryer with hot air for example.

35

The ready-to-eat food bar may be conditioned in a packing providing for its protection against humidity, such as a packing made of a film with aluminium foil, for example.

5 The following examples are given as illustration of embodiments of the ready-to-eat food bar and of the process for its manufacture according to the present invention. The parts and percentages are by weight.

10 **Example 1**

For manufacturing a ready-to-eat food bar comprising particles and/or flakes of various cooked-extruded bases, rice particles, wheat particles and corn flakes were  
15 prepared as follows:

Particles of cooked-extruded-expanded rice base

A mixture was prepared which had the following composition,  
20 (in parts, except added water):

rice flour	80
cristal sugar	4
skimmed milk powder	5.5
sodium chloride	1
calcium carbonate	0.5
added water, up to a water content of	18%

For preparing the mixture, the powders were first mixed together to obtain a dry mix. The dry mix and added water  
25 were then mixed together in the extruder. The mixture obtained in this way was cooked-extruded-expanded with the aid of a BC-45H type CLEXTRAL twin screw extruder having a screw diameter of 55 mm and a total processing length of 800 mm.

Cooking-extruding was carried out at 130°C under 80 bar for 30 s, the two intermeshing screws rotating at 300 rpm. The cooked thermoplastic mass obtained in this way was extruded through a die having eight circular openings 3 mm in diameter.

The thermoplastic mass was extruded into ambient air and immediately cut with a two blade cutter rotating adjacent to the opening at 2000 rpm.

The particles of cooked-extruded-expanded rice base obtained in this way expanded after cutting so that they were about 5 mm in diameter. They had a water content of 8.7%.

The particles were then dried with hot air on a belt dryer to a residual water content of 3.4%.

20 Particles of cooked-extruded-expanded wheat base

A mixture was prepared which had the following composition, (in parts, except added water):

wheat flour	41
wheat starch	18
skimmed milk powder	10
oat flour	9
wheat bran	9
calcium carbonate	0.5
added water, up to a water content of	19%

25

For preparing the mixture, the powders were first mixed together to obtain a dry mix. The dry mix and added water were then mixed together in the extruder. The mixture

obtained in this way was cooked-extruded-expanded with the aid of a BC-45H type CLEXTRAL twin screw extruder having a screw diameter of 55 mm and a total processing length of 800 mm.

5

Cooking-extruding was carried out at 132°C under 100 bar for 30 s, the two intermeshing screws rotating at 300 rpm. The cooked thermoplastic mass obtained in this way was extruded through a die having eight circular openings 3 mm in diameter.

10

The thermoplastic mass was extruded into ambient air and immediately cut with a two blade cutter rotating adjacent to the opening at 2000 rpm.

15

The particles of cooked-extruded-expanded wheat base obtained in this way expanded after cutting so that they were about 5 mm in diameter. They had a water content of 10.6%.

20

The particles were then dried with hot air on a belt dryer to a residual water content of 2.9%.

#### Flakes of cooked-extruded corn base

25

A mixture was prepared which had the following composition, (in parts, except added water):

corn semolina	48
corn starch	17
skimmed milk powder	10
corn bran	9
calcium carbonate	0.5
added water, up to a water content of	24%

For preparing the mixture, the powders were first mixed together to obtain a dry mix. The dry mix and added water were then mixed together in the extruder. The mixture obtained in this way was cooked-extruded with the aid of a  
5 BC-45H type CLEXTRAL twin screw extruder having a screw diameter of 55 mm and a total processing length of 800 mm.

Cooking-extruding was carried out at 160°C under 55 bar for 30 s, the two intermeshing screws rotating at 300 rpm. The  
10 cooked thermoplastic mass obtained in this way was extruded through a die having two circular openings or orifices 5 mm in diameter.

The thermoplastic mass was extruded into ambient air and immediately cut with a two blade cutter rotating adjacent  
15 to the opening at 1450 rpm.

The particles of cooked-extruded corn base obtained in this way expanded only slightly after cutting. They had a water  
20 content of 11.5%.

The particles were rolled to flakes having a thickness of about 0.75 mm.

25 The flakes were then dried with hot air on a belt dryer to a residual water content of 1.0%.

#### Binder

30 A binder was prepared which had the following composition (parts):

fresh milk (2.8% fat)	11.5
glycerin	14
gum-arabic	3
fructose	66

calcium carbonate 0.5

For preparing the binder, the components were mixed together in a double walled tank while being heated to about 50°C.

5

Ready-to-eat food bar

A dry mix was prepared by mixing together 15.6 parts of particles of cooked-extruded-expanded rice base, 15.6 parts of particles of cooked-extruded-expanded wheat base and 18 parts of flakes of cooked-extruded corn base.

10

15

This dry mix was mixed with 4 parts of coco nut fat and 46.8 parts of binder by means of a mixer of the helical spring type.

20

The mass thus obtained was formed into a bar shape by extrusion through a die having a rectangular opening 3 cm in width and 1 cm in height and cut into individual bars 10 cm in length.

25

The bars had a chewy texture, an appetizing taste and could be eaten as they were. They were nutritionally valuable, each individual bar representing a complete meal just as it was.

**Example 2**

30

For manufacturing a ready-to-eat food bar comprising particles of a cooked-extruded-expanded corn and wheat base especially rich in milk protein and calcium, a mixture was prepared which had the following composition, (in parts, except added water):

A mixture was prepared which had the following composition, (in parts, except added water):

corn semolina	49
wheat flour	15
waxy corn starch	10
crystal sugar	12
skimmed milk powder	8
butter oil	6
added water, up to a water content of	12%

5 For preparing the mixture, the powders were first mixed together to obtain a dry mix. The dry mix, oil and added water were then mixed together in the extruder. The mixture obtained in this way was cooked-extruded-expanded with the aid of a BC-45 type CLEXTAL twin screw extruder having a screw diameter of 55 mm and a total processing length of 10 1200 mm.

Cooking-extruding was carried out at 153°C under 50 bar for 30 s, the two intermeshing screws rotating at 350 rpm.

15 The extruder was equipped with a die having eight circular openings 3 mm in diameter.

20 Nitrogen was injected into the thermoplastic mass at a screw processing length of 1030 mm, under 37 bar and at a rate of 80 g/h.

25 The cooked thermoplastic mass thus obtained was extruded into ambient air and immediately cut with a two blade cutter rotating adjacent to the opening at 2000 rpm.

The particles of cooked-extruded-expanded corn and wheat base obtained in this way expanded after cutting so that

they were about 5 mm in diameter. They had a water content of 7.5% and a fine, porous, crunchy, smooth and melt-in-the-mouth texture.

- 5 The particles were then dried with hot air on a belt dryer to a residual water content of 2.9%.

A binder was prepared which had the following composition (parts):

10

fresh milk (2.8% fat)	11.5
glycerin	14
gum-arabic	3
fructose	66
calcium carbonate	0.5

For preparing the binder, the components were mixed together in a double walled tank while being heated to about 50°C.

15

50 parts of dried particles were mixed with 4 parts of coconut fat and 46 parts of binder by means of a mixer of the helical spring type.

20

The mass thus obtained was formed into a bar shape by extrusion through a die having an oval opening 3 cm in width and 1 cm in height and cut into individual bars 10 cm in length.

25

The bars had a chewy texture, an appetizing taste and could be eaten as they were. They were nutritionally valuable and especially rich in milk protein and calcium. Each individual bar represented a complete meal just as it was.

**Claims**

1. A ready-to-eat food bar consisting of agglomerated particles and/or flakes of one or more cooked-extruded bases mainly comprising amyloseous materials and milk solids which are coated with a binder mainly comprising sugar, milk solids and a binding agent.
2. Food bar as claimed in claim 1, comprising, in % by weight, from about 6 to 18% of protein, from about 60 to 80% of available carbohydrate and from about 2.5 to 15% of fat.
3. Food bar as claimed in claim 1, comprising, in % by weight, from 5.5 to 27.5% of milk solids non fat, from 2.5 to 12.5% of milk fat and/or vegetable fat, from 30 to 60% of amyloseous material, from 5 to 30% of sugar, from 0.2 to 1.5% of binding agent and from 1.0 to 8.0% of residual water.
4. Food bar as claimed in claim 1, comprising, in % by weight, from more than 11 to 27.5% of milk solids non fat, from more than 5 to 12.5% of milk fat and/or vegetable fat, from 30 to 60% of amyloseous material, from 5 to 30% of sugar, from 0.2 to 1.5% of binding agent and from 1.0 to 8.0% of residual water.
5. A process for manufacturing a ready-to-eat food bar consisting of preparing a dry mixture of particles and/or flakes of one or more cooked-extruded bases mainly comprising amyloseous materials and milk solids, mixing the dry mixture with a binder mainly comprising sugar, milk solids and a binding agent, and forming the mass thus obtained into a bar shape.

6. A process as claimed in claim 5, in which particles of a cooked-extruded-expanded base are prepared by cooking-extruding-expanding at 120 to 170°C under 40 to 160 bar for 5 to 50 s a mixture comprising, in parts by weight, from 5.5 to 27.5 parts of milk solids non fat, from 2.5 to 12.5 parts of milk fat and/or vegetable fat, from 50 to 80 parts of amylaceous material, up to 12 parts of sugar, and added water up to a water content of from 11 to 19% by weight of the mixture, thus obtaining a rope of a thermo plastic mass having a porous texture and cutting the rope into pieces.

7. A process as claimed in claim 5, in which flakes of a cooked-extruded base are prepared by cooking-extruding-expanding at 120 to 170°C under 40 to 160 bar for 5 to 50 s a mixture comprising, in parts by weight, from 5.5 to 27.5 parts of milk solids non fat, from 2.5 to 12.5 parts of milk fat and/or vegetable fat, from 50 to 80 parts of amylaceous material, up to 12 parts of sugar, and added water up to a water content of from 20 to 30% by weight of the mixture, thus obtaining a rope of a thermo plastic mass, cutting the rope into pieces, rolling the pieces to flakes and drying them.

8. A process as claimed in claim 5, in which the binder comprises, in parts by weight, from 10 to 70 parts of sugar, from 0.5 to 5 parts of binding agent, up to 40 parts of whole milk solids, up to 15 parts of glycerin, up to 60 parts of fruit pulp or concentrate, up to 10 parts of cocoa powder, and added water up to a water content of from 10 to 30%.