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(54) METHOD FOR PACKAGING A HIGH TEXTURED DAIRY PRODUCT

VERFAHREN ZUM VERPACKEN EINES HOCHTEXTURIERTEN MILCHPRODUKTS
PROCÉDÉ DE CONDITIONNEMENT D'UN PRODUIT LAITIER FORTEMENT TEXTURÉ

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Description

[0001] The present invention relates to a method for filling, in a reproducible and stable manner, a container with a high textured dairy product, having more particularly a viscosity comprised between 1400 and 3800 mPa.s at the filling stage.

[0002] Dairy products have generally a fluid texture leading to a smooth surface when they are filled in a container. Indeed, due to its fluid texture, the dairy product distributes homogeneously in the container. EP 0818149 discloses a method for filling a container with a dairy product wherein the product is cooled before being packaged in the containers.

[0003] The obtaining of such a smooth surface is difficult when the container is filled with a high textured dairy product. A conventional filling of these products leads generally to a heterogeneous surface which may not be attractive for the consumers.

[0004] However, it is desired to maintain the organoleptic properties of a product from a container to another, in terms of taste and texture but also in terms of visual aspect. Indeed, the reproducibility of the organoleptic properties allows guaranteeing the consumer of the high quality of the product.

[0005] There is thus a need for providing a method allowing to obtain a well-defined surface (representing notably a unique visual product signature as a surface print) of a high textured dairy product contained in a container, such well-defined surface being reproducible (i.e. the same surface is obtained in each container filled with the high textured dairy product) and stable overtime (i.e. during storage of the container filled with the dairy product).

[0006] The present invention provides thus a method for filling a container with a high textured dairy product allowing solving such a problem.

[0007] The present invention has thus for subject-matter a method for filling a container with a dairy product having a viscosity comprised between 1400 and 3800 mPa.s measured by a viscosimeter, more particularly of Rheomat type, equipped with a measuring bob / measuring tube system of type 2 / 2 with a shear rate of 64 s^{-1} during 90 s at 10°C comprising the steps of:

(a) filling the container with the dairy product by means of a dispenser equipped with a nozzle comprising at least two openings, at a flow rate by surface of the nozzle openings comprised between 0.5 and $1.2 \text{ kg}/(\text{h} \times \text{mm}^2)$ and at a temperature comprised between 4 and 30°C , and

(b) if the temperature of the dairy product in step (a) is above 10°C , cooling the dairy product in the container to a temperature comprised between 2 and 10°C , preferably between 4 and 6°C .

[0008] The method according to the invention allows thus obtaining a well-defined surface of the dairy product which is:

- reproducible, meaning that the same well-defined surface is obtained in each container filled with the high textured dairy product, and
- stable, meaning that the well-defined surface remained unchanged during storage of the container filled with the dairy product.

[0009] The well-defined surface remains stable during at least 15 days, notably during at least 20 days, in particular during at least 30 days, advantageously during at least 40 days, preferably during at least 50 days and most preferably during at least 60 days (i.e. during all the shelf life of the dairy product) at the storage temperature of the dairy product which is advantageously between 2 and 10°C , preferably between 4 and 6°C .

[0010] The well-defined surface is not smooth in view of the high viscosity of the dairy product and presents thus heterogeneities. However, these heterogeneities are organized and well-defined to be always the same and arranged in the same way from a container to another container in order to represent a visual signature for the consumers. In a particular embodiment, the well-defined surface can have the appearance of a defined form which optionally can represent something for the consumers (for example a flower). This form will be dependent on the form of the opening(s) of the nozzle.

Container:

[0011] The container can have any appropriate shape, in particular an ovoid or circular shape, such as a cup, any appropriate size and made in any appropriate material, such as plastic, aluminium or glass, in particular plastic.

[0012] In particular, the container will be adapted to be filled with 50 to 1000 g of dairy product, preferably between 100 and 500 g, even more preferably between 125 and 200 g.

[0013] Before being filled with the dairy product, the container can have been filled with a food preparation, which can be a fruit-based preparation, a flavoured milk-based preparation, a cereal-based preparation, honey or mixtures thereof, in which can be present chocolate pieces, caramel pieces, nut pieces or mixtures thereof. Thus, the container can contain

a layer of a food preparation before being filled with the dairy product.

[0014] The fruit-based preparation can be selected from fruit puree, fruit compote, fruit sauce, fruit coulis, fruit jam, fruit jelly or mixtures thereof. The fruit-based preparation can further contain fruit pieces.

[0015] For example, the fruit(s) of the fruit-based preparation can be selected from strawberry, raspberry, blackberry, blueberry, cherry, apricot, peach, pear, apple, plum, pineapple, mango, banana, papaya, passion fruit, pomelo, orange, lemon, kiwi, coconut, vanilla and mixtures thereof.

[0016] The flavoured milk-based preparation can be a cream or a sauce. The preparation can have for example a chocolate, vanilla, caramel, praline, pistachio, hazelnut or coffee flavor.

[0017] The cereal-based preparation can be for example corn flakes or puffed rice, notably coated with chocolate.

[0018] The nut pieces can be, for instance, pieces of almonds, hazelnuts, walnuts, cashew nuts, pecan nuts, Brazil nuts, pistachios, Macadamia nuts, Queensland nuts or mixtures thereof.

[0019] The food preparation can represent from 0 to 50 wt%, preferably, from 0.5 to 40 wt%, even more preferably from 5 to 20 wt%, of the total product contained in the container (i.e. the dairy product and the food preparation).

Dairy product:

[0020] In the context of the present invention, "dairy product" designates more particularly a dairy product ready for human consumption made from milk of animal or vegetal origin.

[0021] The dairy product based on milk of animal origin can be made from whole milk and/or wholly or partly skimmed milk, which can be used in a powder, concentrated or retentate form which can be reconstituted by addition of water. Other milk components can be added such as cream, casein, caseinate (for ex. calcium or sodium caseinate), whey proteins notably in the form of a concentrate (WPC), milk proteins notably in the form of a concentrate (MPC), milk protein hydrolysates and mixtures thereof.

[0022] The milk and milk components of animal origin can have a cow, goat, sheep, buffalo, donkey or camel origin, preferably a cow origin.

[0023] The dairy product based on milk of vegetal origin can be made from grain milk such as barley milk, oat milk, rice milk or spelt milk; legumes-based milk such as lupin milk, pea milk, peanut milk or soy milk; nut milk such as almond milk, cashew milk, hazelnut milk or walnut milk; or seed milk such as hemp milk, quinoa milk, sesame seed milk, sunflower seed milk or coconut milk. It contains thus vegetal proteins. Preferably, the dairy product based on milk of vegetal origin will be made from soy milk, oat milk, rice milk or almond milk.

[0024] According to a preferred embodiment, the dairy product is made from milk and milk components of animal origin, and in particular of cow origin.

[0025] Food additives can also be present, notably chosen among:

- sugars and sweeteners:

sugars and sweeteners are food-acceptable carbohydrate sweetening agents that may be natural or artificial, no or low calorie sweeteners;

preferred examples of appropriate sugars are sucrose, fructose, lactose, glucose and maltose, wherein such sugars can be incorporated in the form of beet sugar, cane sugar, maple sugar, molasses, corn syrup, malt syrup, maple syrup, agave nectar or also honey;

preferred examples of appropriate no or low calorie sweeteners are aspartame, sucralose, acesulfame potassium, saccharin, sodium cyclamate, thaumatin, tagatose, neohesperidin dihydrochalcone, isomaltulose, rebaudioside A or also a stevia extract (containing rebaudioside A),

- vitamins (e.g. vitamin A, B1, B2, B6, B12, C, D, E or K, folic acid, etc.),
- salts
- anti-oxidants,
- pH-modifying agents (e.g. buffering agents or acidifying agents such as citric acid and its salts, for ex. sodium, potassium or calcium citrate),
- lubricants (e.g. vegetable oils),
- preservatives (e.g. sorbic acid and its salts such as sodium, potassium and calcium salts, sulphur dioxide, benzoic acid and its salts such as sodium, potassium and calcium salts, ethyl, methyl or propyl p-hydroxybenzoate, etc.),
- taste exhausters (e.g. glutamic acid and its salts such as sodium, potassium, calcium, magnesium or ammonium salts),
- texturizing agents:
texturizing agents are used to modify the overall texture or mouthfeel of a food product and include gelling agents (for ex. gelatine, agar, carrageenan, pectin, natural gums), stabilisers (for ex. starch, agar, pectin, Arabic gum,

gelatin), emulsifiers (for ex. lecithin, mono- and di-glycerides of fatty acids (E471), esters of mono- and di-glycerides of fatty acid (E472a-f)), and thickeners (for ex. guar gum, xanthan gum, pectin, starch, agar, carrageenan, alginic acid),

- flavouring aromatic agents of synthetic or natural origin (e.g. fruit flavours), and
- colouring agents (pigments, dyes, etc.),
- enzymes such as lactase,
- vegetal ingredients,
- fibers such as inuline or oligofructose.

[0026] If need be, the skilled person will be able to choose appropriate food additives among all the well-known food additives and excipients available on the market.

[0027] These food additives could be present also in the food preparation which can be used to form a layer in the bottom of the container.

[0028] According to a first embodiment, the dairy product is a fermented dairy product.

[0029] In the context of the present invention, "fermented dairy product" designates more particularly a fermented dairy product ready for human consumption, such as a fermented milk, a yoghurt, or a fresh cheese such as a white cheese or a petit-suisse. It can be also a strained fermented dairy product such as a strained yoghurt also called concentrated yoghurt or Greek-style yoghurt.

[0030] The terms "fermented milk" and "yoghurt" are given their usual meanings in the field of the dairy industry, that is, products intended for human consumption and originating from acidifying lactic fermentation of a milk substrate, having an animal or vegetal origin, preferably an animal origin. These products can contain secondary ingredients such as fruits, vegetables, sugar, etc.

[0031] The expression "fermented milk" is thus reserved in the present application for a dairy product prepared with a milk substrate which has undergone treatment at least equivalent to pasteurisation, seeded with microorganisms belonging to the characteristic species or species of each product.

[0032] The term "yoghurt" is reserved for fermented milk obtained, according to local and constant usage, by the development of specific thermophilic lactic bacteria known as *Lactobacillus delbrueckii* subsp. *bulgaricus* and *Streptococcus thermophilus*, which must be in the living state in the finished product, at a minimum rate. In certain countries, regulations require the addition of other lactic bacteria to the production of yoghurt, and especially the additional use of strains of *Bifidobacterium* and/or *Lactobacillus acidophilus* and/or *Lactobacillus casei* and/or *Lactobacillus rhamnosus* and/or *Propionibacterium*. These additional lactic strains are intended to impart various properties to the finished product, such as that of favouring equilibrium of intestinal flora or modulating the immune system.

[0033] In practice, the expression "fermented milk" is therefore generally used to designate fermented milks other than yoghurts. It can also, according to country, be known by names as diverse as, for example, "Kefir", "Kumtss", "Lassi", "Dahi", "Leben", "Filmjolk", "Villi", "Acidophilus milk", skyr, greek.

[0034] Finally, the name "white cheese" or "petit-Suisse" is, in the present application, reserved for unrefined non-salty cheese, which has undergone fermentation by lactic bacteria only (and no fermentation other than lactic fermentation but an additional enzymatic coagulation).

[0035] In the present invention, the fermented dairy product will be advantageously a strained fermented dairy product such as a strained yoghurt also called concentrated yoghurt or Greek-style yoghurt.

[0036] In order to prepare the fermented dairy product, a non-fermented dairy product, also called "white mass" and containing the milk and milk components and optionally other food additives, is generally first pasteurised before being fermented.

[0037] The pasteurisation step is a heating treatment at a temperature comprised between 72°C and 138°C, preferably during 2 seconds to 30 minutes. Such a step and its conditions are well known to the one skilled in the art.

[0038] The fermentation step is a lactic fermentation using techniques which are known to the skilled person.

[0039] When reference is made to a "lactic fermentation", this means an acidifying lactic fermentation which results in milk coagulation and acidification following the production of lactic acid which may be accompanied by the production of other acids, carbon dioxide and various substances such as exopolysaccharides (EPS) or aromatic substances, for example diacetyl and acetaldehyde.

[0040] To perform such a lactic fermentation, lactic ferments are added to the non-fermented dairy product, which has generally been pasteurized beforehand, and the temperature is kept between 25°C and 44°C, preferably for 3 to 25 hours.

[0041] In the framework of the present invention, various ferments can be used for performing the fermentation of the dairy product and in particular a culture of lactic acid bacteria such as:

- *Lactobacillus* sp. (for ex. *Lactobacillus bulgaricus*, *Lactobacillus acidophilus*, *Lactobacillus paracasei*, *Lactobacillus casei*, *Lactobacillus pentosus*, *Lactobacillus helveticus*, *Lactobacillus reuteri*, *Lactobacillus plantarum*, *Lactobacillus bifidus* and combinations thereof),
- *Lactococcus* sp. (for ex. *Lactococcus lactis* subsp. *lactis* and *Lactococcus lactis* subsp. *cremoris*),

- *Bifidobacterium* sp. (for ex. *Bifidobacterium bifidum*, *Bifidobacterium infantis*, *Bifidobacterium animalis*, especially *Bifidobacterium animalis* subsp. *lactis*, *Bifidobacterium breve*, *Bifidobacterium longum* and combinations thereof), and
- *Streptococcus* sp. (for ex. *Streptococcus thermophilus*, *Streptococcus lactis*, *Streptococcus raffinolactis*, *Streptococcus cremoris* and combinations thereof).

[0042] Preferred lactic acid bacteria to be used in the present invention are selected from *Lactobacillus bulgaricus*, *Streptococcus thermophilus*, *Lactococcus lactis*, *Bifidobacterium animalis* subsp. *lactis*, and combinations thereof.

[0043] When the fermented dairy product is cheese, rennet will be also present to coagulate the milk (enzymatic coagulation).

[0044] According to a second embodiment, the dairy product is a non-fermented dairy product.

[0045] In the context of the present invention, "non-fermented dairy product" designates more particularly a dairy product ready for human consumption which has not been fermented, such as a neutral or acid dairy dessert, in particular a cream dessert, a custard, a Bavarian cream, a pastry cream or a cheesecake.

[0046] According to a preferred embodiment, the dairy product is a fermented dairy product, preferably made from milk and milk components having an animal origin, such as a cow origin. It can be in particular a strained fermented dairy product as disclosed in WO 2014/114970.

[0047] The dairy product used in the method according to the present invention is a high textured dairy product, i.e. a thick dairy product having a viscosity comprised between 1400 and 3800 mPa.s, notably between 1500 and 3500 mPa.s, advantageously between 1500 and 3000, preferably between 1700 and 2200 mPa.s, even more preferably between 1800 and 2000 mPa.s.

[0048] The viscosity is measured by a viscosimeter, more particularly of Rheomat type, equipped with a measuring bob / measuring tube system of type 2 / 2 with a shear rate of 64 s^{-1} during 90 s at 10°C . The viscosimeter can be for example a Rheomat 180. The measuring bob / measuring tube system of 2-2 type is a system in which the measuring bob is of type 2 and has a diameter of 24 mm and the measuring tube is of type 2 and has a diameter of 26.03 mm.

[0049] When the viscosity is below 1400 mPa.s, the viscosity is too low to obtain a defined print on the surface of the dairy product. Moreover, if a food preparation layer is present in the container, the dairy product having a too low viscosity will blend with the fruit preparation.

[0050] When the viscosity is above 3800 mPa.s, the dairy product is very difficult to pump. If the dairy product can be pumped anyway, a non-reproducible surface is obtained; the viscosity is too high and the dairy product cracks in the container which destroys the "well defined surface".

[0051] The viscosity of the dairy product is the viscosity as measured before the filling step (a). Indeed, this viscosity can change during the shelf life of the product. In particular, the viscosity of a fermented dairy product increases during its shelf life.

[0052] The "total protein content" of the dairy product corresponds to the weight of the proteins present in the dairy product relatively to the total weight of the dairy product. The total protein content is expressed as a weight percentage.

[0053] The total protein content can be measured by Kjeldahl analysis (NF EN ISO 8968-1) as the reference method for the determination of the total protein content of dairy products based on measurement of total nitrogen content. The method is described in both AOAC Method 991.20 (1) and international Dairy Federation Standard (IDF) 20B:1993. Herein the total protein content can be considered as the nitrogen content multiplied by 6.38.

[0054] If the total protein content is known for all the ingredients used to prepare the dairy product, the total protein content of the dairy product can be calculated from these data.

[0055] The dairy product can have a total protein content comprised between 6 and 14%, notably between 7 and 12%, such as between 8 and 10%.

[0056] The "fat content" of the dairy product corresponds to the weight of the fat components present in the dairy product relatively to the total weight of the dairy product. The fat content is expressed as a weight percentage.

[0057] The fat content can be measured by the Weibull-Berntrop gravimetric method described in the standard NF ISO 8262-3.

[0058] If the fat content is known for all the ingredients used to prepare the dairy product, the fat content of the dairy product can be calculated from these data.

[0059] The dairy product can have a fat content comprised between 0 and 11%, notably, between 1 and 4%, such as between 2 and 3.5%.

[0060] According to a preferred embodiment, the dairy product has a total protein content comprised between 7 and 12% and a fat content comprised between 0 and 11%, preferably a total protein content comprised between 6 and 14% and a fat content comprised between 1 and 4%, even more preferably a total protein content comprised between 8 and 10% and a fat content comprised between 2 and 3.5%.

Method:Dispenser:

5 **[0061]** The dispenser is any apparatus allowing dispensing the dairy product in the container.

[0062] According to a preferred embodiment, the dispenser is a dosing dispenser, i.e. a dispenser allowing dispensing a defined amount of dairy product in the container. For that, the dosing dispenser comprises advantageously a chamber which will be filled with the required amount of dairy product. This chamber is placed above the nozzle and is equipped with a piston. Upon pressure, the piston will allow pushing out the required amount of dairy product in the container.

10 **[0063]** The pressure applied on the piston to push out the dairy product is adjusted with a fine setting. Advantageously, this pressure is comprised between 10 and 100 kPa, notably between 30 and 80 kPa.

[0064] The dispenser comprises a nozzle having at least two openings through which the dairy product flows. According to the invention, this nozzle will comprise at least two openings, notably between 2 and 30, preferably between 3 and 16, such as between 5 and 10, openings.

15 **[0065]** When there are several openings, the openings are identical, i.e. they have the same size and shape, or not. According to a particular embodiment, all the openings are identical. For example, all the openings can be in the form of a circle having the same diameter (for example, 8 circle openings with a diameter of 6 mm²) or an oval.

[0066] Advantageously, the openings are homogeneously distributed at the end of the nozzle. For example, they can be arranged in circle.

20 **[0067]** The total surface of the openings of the nozzle is advantageously comprised between 150 and 400 mm², notably between 200 and 350 mm².

[0068] The dispenser, including the nozzle, can be fixed or the dispenser, and more particularly the nozzle, can move down and up in the container during the filling (for example, at a nozzle up and down speed of 100 mm/s). It is also possible to move the container up and down, instead of the dispenser.

Step (a):

[0069] This step (a) has to be carried out at a temperature comprised between 4 and 30°C, notably between 8 and 20°C, even more particularly between 10 and 18°C.

30 **[0070]** If the temperature of step (a) is above 30°C, in particular above 20°C, it may be difficult to obtain the required viscosity of the dairy product. Thus, the dairy product may be too fluid to allow the formation and the maintaining of a well-defined and organized surface since the surface will be too fluid.

[0071] If the temperature of step (a) is below 4°C, in particular below 8°C, the filled dairy product will have the form of a non-reproducible "mountain" with a risk of touching the lid. The structure of the surface will then be further perturbed when the container is closed with the lid. When the nozzle of the dispenser comprises several openings, there will be moreover a fragmentation of the cooled dairy product between the portions issued from the various openings.

35 **[0072]** The flow rate by surface of the nozzle openings (i.e. the flow rate relative to the total surface of the opening(s) of the nozzle) is comprised between 0.5 and 1.2 kg/(h x mm²), advantageously between 0.65 and 1 kg/(h x mm²), even more advantageously between 0.7 and 0.97 kg/(h x mm²).

40 **[0073]** If the flow rate by surface of the nozzle opening(s) is too high, the following defaults can appear: the surface print results into non-reproducible holes instead of reproducible embossed relief print and/or the "shower" of dairy product jets is opening towards the outside of the cup, depositing the product on the side of the cup causing the lid not to be sealed correctly and the absence of drawing the surface print, and eventually can open up and spray/shower the dairy product outside the cup. If a food preparation is present in the container, there is also a risk of fruit splashing and blending with the white mass or distributing on the container wall.

45 **[0074]** If the flow rate by surface of the nozzle openings is too low, a non-reproducible surface is obtained (formation of a surface looking like "spaghetti" positioned randomly and/or having the form of a non-reproducible "mountain" with a risk of touching the lid). When the surface has the form of a "mountain", the structure of the surface will then be further perturbed when the container is closed with the lid

50 **[0075]** According to a first embodiment, the dairy product has a viscosity comprised between 1400 and 2500 mPa.s and step (a) is carried out at a flow rate by surface of the nozzle openings comprised between 0.5 and 0.8 kg/(h x mm²).

[0076] According to a second embodiment, the dairy product has a viscosity comprised between 2600 and 3800 mPa.s and step (a) is carried out at a flow rate by surface of the nozzle openings comprised between 0.8 and 1.2 kg/(h x mm²).

Step (b):

55 **[0077]** If the temperature of the dairy product in step (a) is above 10°C, the dairy product contained in the container has then to be cooled to its storage temperature, i.e. a temperature comprised between 2 and 10°C, preferably between

4 and 6°C.

[0078] Advantageously, the dairy product contained in the container will be cooled slowly and gradually, notably in an almost linear manner.

[0079] The dairy product will be thus advantageously cooled at a rate comprised between 5 and 15°C/h, notably between 7 and 12°C/h.

[0080] For example, the dairy product can be cooled with fresh air, with an air flow between 3 and 6 m/s and an air temperature between 1.5 and 6°C, notably between 2 and 5°C such as between 3 and 4°C.

[0081] Thus, to bring the dairy product from a temperature of about 20°C to a temperature of about 4°C, it will take advantageously at least 1h30, notably for a container containing 100 to 200g of dairy product.

[0082] The slow cooling kinetic of step (b) allows reaching the storage temperature without provoking fast mass caking of the product. A too fast cooling will lead also to a significant release of whey during storage of the container filled with the dairy product. Moreover, when the nozzle of the dispenser comprises several openings, a too fast cooling of the dairy product could lead to a fragmentation of the cooled dairy product between the portion issued from the various openings.

Additional step:

[0083] The filled container can be closed with a lid.

[0084] The closure of the filled container with a lid can be performed before, after or together with the step b) of cooling. In particular, the closure can be performed before the step b) by any common technique known by the one skilled in the art.

[0085] In particular the container can be closed by a heat sealed plastic film or aluminium foil.

Automatic method:

[0086] According to a preferred embodiment, the method is applied on an automatic packaging line using for example a conveyor belt to move the containers, advantageously placed on a tray (for example 1 to 48, notably 5 to 24, containers are placed on one tray), towards the different areas (filling area, cooling area, etc.). Thus the tray comprising several containers is first conveyed towards the dispenser(s) where each container is filled simultaneously with the dairy product. The containers can be first filled with a food preparation. Then the tray containing the filled container is conveyed towards a cooling tunnel, which gradually cools down the dairy product contained in the containers from its filling temperature to its storage temperature. Before or after this step, and preferably before this step, the tray containing the filled containers is conveyed to an apparatus allowing closing the containers with a lid (notably by heat sealing a plastic film or aluminium foil). The cooled containers are finally packaged for their transportation towards the points of sales.

[0087] Shocks between the containers and the trays containing the containers should thus be prevented at the end of line, after the filling with the dairy product in order to preserve the well-defined surface obtained. In particular, change of level should be avoided on the line, as well as too high acceleration during conveyance of the trays.

[0088] The invention will be better understood in view of the following examples and figures, these examples serving solely to illustrate the invention.

FIGURES:

[0089]

Figure 1 represents a nozzle with (A) 9 openings or (B) 6 openings which can be used in the present invention.

Figure 2 represents photographs of the surface of dairy products obtained after the filling step when the viscosity of the dairy product is (A) in the range according to the invention, (B) below this range, or (C) above this range.

Figure 3 represents photographs of the surface of dairy products obtained after the cooling step when the cooling step is (1) slow or (2) fast.

Figure 4 represents various containers which can be used in the present invention.

EXAMPLES:

1. Material

1.1. Dairy product

[0090] The dairy products used in the following examples were strained yoghurts having the following features:

Dairy Product	Ex. A according to the invention	Ref. Ex. B with a low viscosity	Ref. Ex. C with a high viscosity
Total protein content	9.75 to 10.25	9.5 to 9.75	9.75 to 10.4
Fat content	0.1-0.25	0.1 - 0.25	0.1 - 0.25
Viscosity (at the filling stage)	3200 (+/- 300)	≤ 1400	≥ 3800

[0091] These strained yoghurts have been prepared as follows:

- pre-heat at 75°C of fresh prepasteurized skimmed milk having a total protein content of 3 to 3.6%,
- homogenization at 5 to 25 MPa,
- pasteurization at 92°C and holding during 5 min
- cooling to fermentation temperature (40°C),
- inoculation at 80% of tank filling with thermophilic yoghurt strains consisting of *L. Bulgaricus* and *S. Thermophilus*,
- fermentation during 5.5 h,
- thermoshock at 58°C during 2.5 min,
- cooling to mechanical separation temperature at (40°C),
- centrifugal separation to increase the total protein content,
- smoothing with a dynamic rotary smoother,
- cooling to 18°C,
- storage under moderate intermittent agitation conditions

1.2. Food preparation

[0092] The food preparation used in some of the following examples was:

- peach fruit preparation with 47% brix, pH = 3,8, cenco 5,
- passion fruit preparation with 50% brix, pH 3.6, cenco 5.5,
- strawberry fruit preparation with 45% brix, pH 3.8, cenco 5, or
- cherry fruit preparation with 50% brix, pH 3.8, cenco 5.

[0093] It was prepared by mixing and heating up to 70°C the ingredients in batch as pre-heat, reaching the pasteurising temperature of 95°C up to 5 min, decreasing the temperature in batch to 25°C.

1.3. Container

[0094] The containers used in the following examples were plastic cups having a circle form (more particularly a form of a truncated cone) (see Figure 4). They are intended to receive 150-160 g of dairy product.

1.4. Dispenser

[0095] Various dosing dispensers were used in the following examples. They were equipped with a nozzle comprising 6, 8 or 9 openings having the following features:

- nozzle (1) with 6 openings: the openings are identical, have the form of an enlarging oval and an area of 55 mm² and are arranged in circle;
- nozzle (2) with 8 openings: the openings are identical, have the form of a circle and an area of 28,26 mm² and are arranged in circle;
- nozzle (3) with 9 openings: the openings are identical and have the form of a circle and an area of 28,26 mm²; 8 of the openings are arranged in circle and the last openings is placed in the center of the circle formed by the other 8 openings.

[0096] The nozzle with 9 openings and the one with enlarging ovals are represented on Figure 1.

2. Effect of viscosity

[0097] Dairy products having various viscosities have been used in this example, i.e. the dairy products A, B and C as disclosed in paragraph 1.1 above.

[0098] Plastic cups defined above have been first filled with 30-32 g of a food preparation defined previously. These plastics cups comprising a food preparation layer have been then filled with 150-160 g of these dairy products in the following conditions:

- flow rate: 1200 kg/h;
- number of cups filled / stroke: 5;
- nozzle: 6 holes of 55 mm²;
- flow rate by surface of nozzle openings: 0.73 kg/(h x mm²);
- pressure applied on the piston: 30-80 kPa.

[0099] Figure 2 presents photographs of the surface of the dairy products obtained for the three cases.

[0100] A perfectly defined and reproducible surface having a "flower print" is obtained with the dairy product having a viscosity according to the invention (Fig. 2A).

[0101] On the contrary, when the dairy product has a too low viscosity, no defined and reproducible surface is obtained and the dairy product mixed with the food preparation (Fig. 2B).

[0102] When the dairy product has a too high viscosity, a surface in the form of a mountain is obtained which has the further disadvantage to touch the lid (Fig. 2C).

3. Effect of cooling step

[0103] Plastic cups filled with a dairy product according to the invention have been cooled from about 18°C to about 6°C in the following various conditions:

	1 (slow cooling)	2 (fast cooling)
Cooling means	Fresh air with an air flow of about 3.6-4m/s and an air temperature of about 4°C	Fresh air with an air flow ≥ 6 m/s and an air temperature of about 0-1°C
Cooling duration	1.5h - 2h	45 min - 1h

[0104] Figure 3 presents photographs of the surface of the dairy products obtained for these two cases.

[0105] Fig.3-2 shows that the too fast cooling step leads to a significant release of whey and a fragmentation of the cooled dairy product between the portions issued from the various openings of the nozzle, compared to the dairy product obtained after a slower cooling step (Fig. 3-1).

Claims

1. A method for filling a container with a dairy product having a viscosity comprised between 1400 and 3800 mPa.s measured by a viscosimeter equipped with a measuring bob / measuring tube system of type 2 / 2 with a shear rate of 64 s⁻¹ during 90 s at 10°C comprising the steps of:

- (a) filling the container with the dairy product by means of a dispenser equipped with a nozzle comprising at least two openings, at a flow rate by surface of the nozzle openings between 0.5 and 1.2 kg/(h x mm²) and at a temperature comprised between 4 and 30°C, in particular between 8 and 20°C, and
- (b) if the temperature of the dairy product in step (a) is above 10°C, cooling the dairy product in the container to a temperature comprised between 2 and 10°C, preferably between 4 and 6°C.

2. The method according to claim 1, wherein the dairy product has a viscosity comprised between 1400 and 2500 mPa.s and step (a) is carried out at a flow rate by surface of the nozzle openings comprised between 0.5 and 0.8 kg/(h x mm²).

3. The method according to claim 1, wherein the dairy product has a viscosity comprised between 2600 and 3800 mPa.s and step (a) is carried out at a flow rate by surface of the nozzle openings comprised between 0.8 and 1.2 kg/(h x mm²).

4. The method according to any one of claims 1 to 3, wherein the total surface of the openings of the nozzle is comprised between 150 and 400 mm², notably between 200 and 350 mm².

5. The method according to any one of claim 1 to 4, wherein the nozzle comprises 2 to 30, notably 3 to 16, preferably 5 to 10, openings.

6. The method according to any one of claims 1 to 5, wherein all the openings have the same size and the same shape.

7. The method according to any one of claims 1 to 6, wherein the openings are disposed uniformly at the end of the nozzle.

8. The method according to any one of claims 1 to 7, wherein the dairy product is cooled in step (b) at a rate comprised between 5 and 15°C/h, notably between 7 and 12°C/h.

9. The method according to any one of claims 1 to 8, wherein the dairy product is cooled in step (b) with fresh air, with an air flow between 3 and 6 m/s and an air temperature between 1.5 and 6°C, notably between 2 and 5°C, such as between 3 and 4°C.

10. The method according to any one of claims 1 to 9, wherein the dairy product has a total protein content comprised between 6 and 14%, notably between 7 and 12%, such as between 8 and 10%.

11. The method according to any one of claims 1 to 10, wherein the container used in step (a) already contains a food preparation layer.

12. The method according to claim 11, wherein the food preparation is a fruit-based preparation, a flavoured milk-based preparation, a cereal-based preparation, honey or a mixture thereof, optionally further containing chocolate pieces, caramel pieces, nut pieces or a mixture thereof.

13. The method according to claim 12, wherein:

- the fruit-based preparation is selected from fruit puree, fruit compote, fruit sauce, fruit coulis, fruit jam, fruit jelly and mixtures thereof, and optionally further contains fruit pieces;
- the flavoured milk-based preparation is a cream or a sauce with a chocolate, vanilla, caramel, praline, pistachio, hazelnut or coffee flavor;
- the cereal-based preparation is corn flakes or puffed rice, notably coated with chocolate; and
- the nut pieces are pieces of almonds, hazelnuts, walnuts, cashew nuts, pecan nuts, Brazil nuts, pistachios, Macadamia nuts, Queensland nuts or mixtures thereof.

14. The method according to claim 12 or 13, wherein the fruit of the fruit-based preparation is selected from strawberry, raspberry, blackberry, blueberry, cherry, apricot, peach, pear, apple, plum, pineapple, mango, banana, papaya, passion fruit, pomelo, orange, lemon, kiwi, coconut, vanilla and mixtures thereof.

Patentansprüche

1. Verfahren zum Befüllen eines Behälters mit einem Molkereiprodukt, das eine Viskosität im Bereich zwischen 1400 und 3800 mPa.s aufweist, gemessen mit einem Viskosimeter, das mit einem Messkörper- / Messrohrsystem von Typ 2 / 2 ausgestattet ist, mit einer Scherrate von 64 s⁻¹ während 90 s bei 10 °C, umfassend die Schritte des:

- (a) Befüllens des Behälters mit dem Molkereiprodukt mittels eines Spenders, der mit einer Düse ausgestattet ist, die mindestens zwei Öffnungen umfasst, bei einer Strömungsrate pro Fläche der Düsenöffnungen von zwischen 0,5 und 1,2 kg/(h x mm²) und bei einer Temperatur im Bereich zwischen 4 und 30 °C, insbesondere zwischen 8 und 20 °C, und
- (b) wenn die Temperatur des Molkereiprodukts in Schritt (a) über 10 °C beträgt, Kühlens des Molkereiprodukts

im Behälter auf eine Temperatur im Bereich zwischen 2 und 10 °C, vorzugsweise zwischen 4 und 6 °C.

2. Verfahren nach Anspruch 1, wobei das Molkereiprodukt eine Viskosität im Bereich zwischen 1400 und 2500 mPa.s aufweist, und Schritt (a) bei einer Strömungsrate pro Fläche der Düsenöffnungen im Bereich zwischen 0,5 und 0,8 kg/(h x mm²) ausgeführt wird.
3. Verfahren nach Anspruch 1, wobei das Molkereiprodukt eine Viskosität im Bereich zwischen 2600 und 3800 mPa.s aufweist, und Schritt (a) bei einer Strömungsrate pro Fläche der Düsenöffnungen im Bereich zwischen 0,8 und 1,2 kg/(h x mm²) ausgeführt wird.
4. Verfahren nach einem der Ansprüche 1 bis 3, wobei die Gesamtfläche der Öffnungen der Düse im Bereich zwischen 150 und 400 mm², vor allem zwischen 200 und 350 mm² liegt.
5. Verfahren nach einem der Ansprüche 1 bis 4, wobei die Düse 2 bis 30, vor allem 3 bis 16, vorzugsweise 5 bis 10 Öffnungen umfasst.
6. Verfahren nach einem der Ansprüche 1 bis 5, wobei alle die Öffnungen dieselbe Größe und dieselbe Form aufweisen.
7. Verfahren nach einem der Ansprüche 1 bis 6, wobei die Öffnungen gleichmäßig am Ende der Düse angeordnet sind.
8. Verfahren nach einem der Ansprüche 1 bis 7, wobei das Molkereiprodukt in Schritt (b) bei einer Rate im Bereich zwischen 5 und 15 °C/h, vor allem zwischen 7 und 12 °C/h gekühlt wird.
9. Verfahren nach einem der Ansprüche 1 bis 8, wobei das Molkereiprodukt in Schritt (b) mit frischer Luft gekühlt wird, mit einer Luftströmung zwischen 3 und 6 m/s und einer Lufttemperatur zwischen 1,5 und 6 °C, vor allem zwischen 2 und 5 °C, wie etwa zwischen 3 und 4 °C.
10. Verfahren nach einem der Ansprüche 1 bis 9, wobei das Molkereiprodukt einen Gesamtproteingehalt im Bereich zwischen 6 und 14 %, vor allem zwischen 7 und 12 %, wie etwa zwischen 8 und 10 % aufweist.
11. Verfahren nach einem der Ansprüche 1 bis 10, wobei der in Schritt (a) verwendete Behälter bereits eine Lebensmittelzubereitungsschicht enthält.
12. Verfahren nach Anspruch 11, wobei die Lebensmittelzubereitung eine Zubereitung auf Fruchtbasis, eine aromatisierte Zubereitung auf Milchbasis, eine Zubereitung auf Getreidebasis, Honig oder eine Mischung davon ist, die gegebenenfalls weiter Schokoladenstückchen, Karamellstückchen, Nussstückchen oder eine Mischung davon enthält.
13. Verfahren nach Anspruch 12, wobei:
 - die Zubereitung auf Fruchtbasis ausgewählt ist aus Fruchtputee, Fruchtkompott, Fruchtsauce, Fruchtcoulis, Fruchtmarmelade, Fruchtgelee und Mischungen davon, und gegebenenfalls weiter Fruchtstückchen enthält;
 - die aromatisierte Zubereitung auf Milchbasis eine Creme oder eine Sauce mit einem Schokoladen-, Vanille-, Karamell-, Praline-, Pistazie-, Haselnuss- oder Kaffee Aroma ist;
 - die Zubereitung auf Getreidebasis Cornflakes oder Puffreis, vor allem mit Schokolade überzogen, sind; und
 - die Nussstückchen Mandel-, Haselnuss-, Walnuss-, Cashewnuss-, Pekannuss-, Paranuss-, Pistazie-, Macadamianuss-, Queenslandnuss-Stücken oder Mischungen davon sind.
14. Verfahren nach Anspruch 12 oder 13, wobei die Frucht der Zubereitung auf Fruchtbasis ausgewählt ist aus Erdbeere, Himbeere, Brombeere, Heidelbeere, Kirsche, Aprikose, Pfirsich, Birne, Apfel, Pflaume, Ananas, Mango, Banane, Papaya, Passionsfrucht, Pomelo, Orange, Zitrone, Kiwi, Kokosnuss, Vanille, und Mischungen davon.

Revendications

1. Méthode de remplissage d'un récipient avec un produit laitier ayant une viscosité comprise entre 1400 et 3800 mPa.s mesurée par un viscosimètre équipé d'un système de plomb de mesure/tube de mesure de type 2/2 avec un taux de cisaillement de 64 s⁻¹ durant 90 s à 10 °C comprenant les étapes suivantes :

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(a) remplir le récipient avec le produit laitier au moyen d'un distributeur équipé d'une buse comprenant au moins deux ouvertures, à un débit d'écoulement par surface des ouvertures de buse entre 0,5 et 1,2 kg/(h x mm²) et à une température comprise entre 4 et 30 °C, en particulier entre 8 et 20 °C, et

(b) si la température du produit laitier à l'étape (a) est supérieure à 10 °C, refroidir le produit laitier dans le récipient à une température comprise entre 2 et 10 °C, de préférence entre 4 et 6 °C.

2. Méthode selon la revendication 1, dans laquelle le produit laitier a une viscosité comprise entre 1400 et 2500 mPa.s et l'étape (a) est exécutée à un débit d'écoulement par surface des ouvertures de buse compris entre 0,5 et 0,8 kg/(h x mm²).

3. Méthode selon la revendication 1, dans laquelle le produit laitier a une viscosité comprise entre 2600 et 3800 mPa.s et l'étape (a) est exécutée à un débit d'écoulement par surface des ouvertures de buse compris entre 0,8 et 1,2 kg/(h x mm²).

4. Méthode selon l'une quelconque des revendications 1 à 3, dans laquelle la surface totale des ouvertures de la buse est comprise entre 150 et 400 mm², notamment entre 200 et 350 mm².

5. Méthode selon l'une quelconque des revendications 1 à 4, dans laquelle la buse comprend 2 à 30, notamment 3 à 16, de préférence 5 à 10, ouvertures.

6. Méthode selon l'une quelconque des revendications 1 à 5, dans laquelle toutes les ouvertures ont la même taille et la même forme.

7. Méthode selon l'une quelconque des revendications 1 à 6, dans laquelle les ouvertures sont disposées de manière uniforme à l'extrémité de la buse.

8. Méthode selon l'une quelconque des revendications 1 à 7, dans laquelle le produit laitier est refroidi à l'étape (b) à un rythme compris entre 5 et 15 °C/h, notamment entre 7 et 12 °C/h.

9. Méthode selon l'une quelconque des revendications 1 à 8, dans laquelle le produit laitier est refroidi à l'étape (b) avec de l'air frais, avec un débit d'air entre 3 et 6 m/s et une température d'air entre 1,5 et 6 °C, notamment entre 2 et 5 °C, telle qu'entre 3 et 4 °C.

10. Méthode selon l'une quelconque des revendications 1 à 9, dans laquelle le produit laitier a une teneur totale en protéines comprise entre 6 et 14 %, notamment entre 7 et 12 %, telle qu'entre 8 et 10 %.

11. Méthode selon l'une quelconque des revendications 1 à 10, dans laquelle le récipient utilisé à l'étape (a) contient déjà une couche de préparation alimentaire.

12. Méthode selon la revendication 11, dans laquelle la préparation alimentaire est une préparation à base de fruits, une préparation à base de lait aromatisé, une préparation à base de céréales, du miel ou un mélange de ceux-ci, contenant en outre éventuellement des morceaux de chocolat, des morceaux de caramel, des morceaux de fruits à coque ou un mélange de ceux-ci.

13. Méthode selon la revendication 12, dans laquelle :

- la préparation à base de fruits est sélectionnée parmi une purée de fruits, une compote de fruits, une sauce de fruits, un coulis de fruits, une confiture de fruits, une gelée de fruits et des mélanges de ceux-ci, et contient en outre éventuellement des morceaux de fruits ;

- la préparation à base de lait aromatisé est une crème ou une sauce avec un arôme de chocolat, de vanille, de caramel, de praline, de pistache, de noisette ou de café ;

- la préparation à base de céréales est des flocons de maïs ou du riz soufflé, notamment recouverts de chocolat ; et

- les morceaux de fruits à coque sont des morceaux d'amandes, de noisettes, de noix, de noix de cajou, de noix de pécan, de noix du Brésil, de pistaches, de noix de macadamia, de noix du Queensland ou des mélanges de ceux-ci.

14. Méthode selon la revendication 12 ou 13, dans laquelle le fruit de la préparation à base de fruits est sélectionné

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parmi la fraise, la framboise, la mûre, la myrtille, la cerise, l'abricot, la pêche, la poire, la pomme, la prune, l'ananas, la mangue, la banane, la papaye, le fruit de la passion, le pamplemousse, l'orange, le citron, le kiwi, la noix de coco, la vanille et des mélanges de ceux-ci.

5

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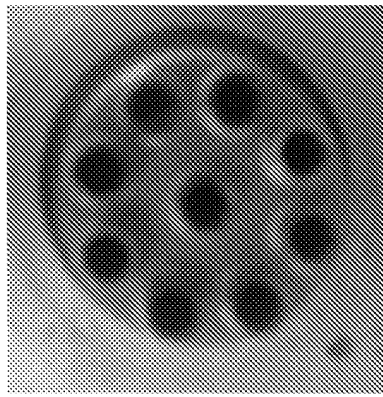
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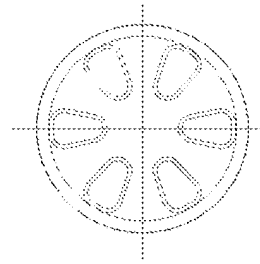
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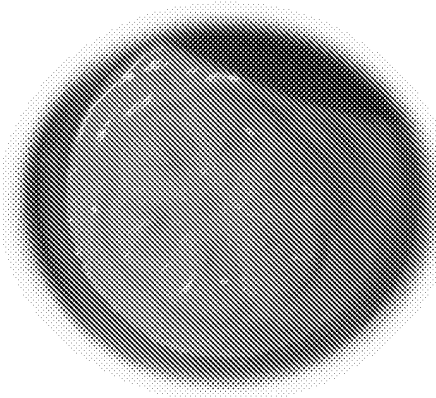


A

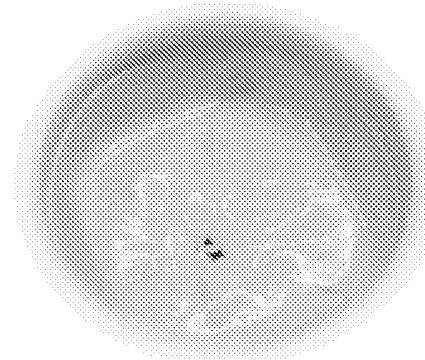


B

Figure 1



A



B



C

Figure 2

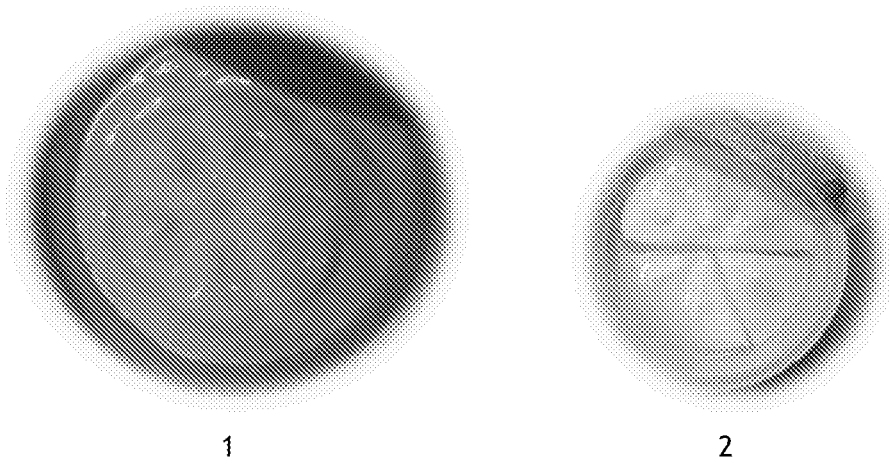


Figure 3

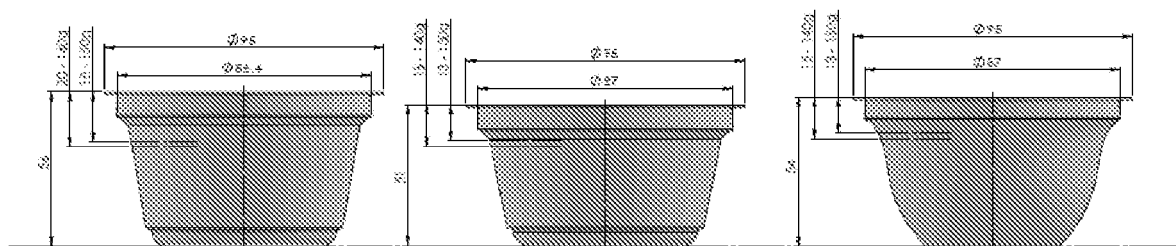


Figure 4

REFERENCES CITED IN THE DESCRIPTION

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