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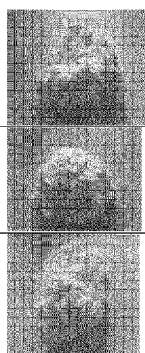


FIGURE 1

(57) Abstract: A method for the manufacture of a whipped cream composition is disclosed. It comprises the steps of: providing a heat-treated acidified milk-based ingredient; mixing said ingredient with a cream component, to obtain a cream composition comprising 18 to 24 wt% of fat; heat-treating the cream composition, cooling it, and then storing it for a period of from 4 to 10 hours; and then, aerating the heat-treated cream composition to obtain a whipped cream composition having an overrun of from 100% to 200%. A whipped cream composition, and a food product comprising the whipped cream composition are also disclosed.



WHIPPED CREAM AND MANUFACTURING METHOD

TECHNICAL FIELD

The present invention relates generally to the field of whipped cream. For example,
5 the present invention relates to a whipped cream having a low-fat content, in particular having shelf-life of several days or weeks under refrigeration.

BACKGROUND OF THE INVENTION

Whipped dairy products, such as whipped cream, are a key component of dairy
10 desserts such as liégeois desserts, where a layer of whipped cream is above a layer of chocolate dessert cream for instance. Whipped cream may also be used as an ingredient in aerated compositions, where whipped cream is mixed with other ingredients, such as fruit-based compositions.

Usually, cream contains a high amount of fat. It is also the case of whipped cream, even
15 though the fat content in whipped cream is lower than that of non-whipped cream per volume unit, thanks to the overrun of the whipped cream. In any case, whipped cream contributes significantly to the fat content and energy content of this category of food products.

In addition, dairy fat is mostly comprised of saturated fatty acids (SFA): dairy fat contains about 70wt% of saturated fatty acids. Recommendations to reduce or limit dietary
20 intake of saturated fat are made, amongst others, by the World Health Organisation (WHO). In 2003, the WHO and the Food and Agriculture Organisation (FAO) concluded in an expert report that "intake of saturated fatty acids is directly related to cardiovascular risk." A traditional target is to limit the dietary intake to 10% of the daily energy intake.

Therefore, there is a need to reduce the content of saturated fatty acids in food
25 products, in order to contribute to the reduction or limitation of the daily SFA intake by consumers, taking into account their whole diet.

Whipped cream provides a light texture to food products, either as an ingredient (for mixing with other ingredient) or as a discernible component of the product, such as a separate layer. It may also impart an attractive visual aspect to the product. Also, fat contributes to the
30 mouthfeel of the whipped cream as well as to its stability over shelf life.

Indeed, foams, such as whipped cream, are meta-stable systems with a low shelf life. Gas bubbles are dispersed in a liquid phase. The bubbles are stabilised by a thin film of milk proteins and milk fat. As soon as the foam is formed, destabilisation begins due to drainage,

coalescence and disproportionation. Drainage is the phenomenon whereby liquid in the thin film drains by gravity. Coalescence is the phenomenon whereby neighbouring gas bubbles merge together, for instance due to disproportionation. Disproportionation occurs due to gas pressure differences between bubbles of unequal sizes.

5 Foam destabilisation can be delayed by high viscosities of the liquid phase, as in a mousse, by drying the system (e.g. dough) or by freezing (e.g. ice-cream). In a mousse, the liquid phase is not removed, as in a dough, or solidified, as in ice-cream. The high viscosity of the liquid phase is not sufficient to avoid destabilisation.

10 Therefore, reducing the fat content may have a negative impact on acceptance and liking by consumers, both due to a less appealing mouthfeel or texture, and to the reduced stability during shelf life.

 In general, chilled dairy products have a shelf life of several weeks under refrigeration. This is to ensure that they remain appealing to the consumer until consumption. For instance, the shelf life of chilled dairy products ranges from 25 to 40 days at 3°C to 5°C. Chilled dairy
15 desserts which contain whipped cream are especially sensitive, due to the inherent instability of their whipped cream component.

 Therefore, there is a need to provide whipped cream having a low fat content and a sufficient shelf life under refrigeration, as well as to provide an industrial process for the manufacture of such a whipped cream.

20 US 3468671 relates to a low-fat whipping cream obtained by combining a cream comprising more than 30% butterfat with buttermilk, to produce a whipping cream comprising 15% to 25% butterfat. Adding skim milk or sodium caseinate is required to improve the consistency of the whipping cream when it contains less than 20% butterfat.

 US 4556574 A (ALFA LAVAL AB) relates to a process for the production of cream. The
25 process comprises concentrating buttermilk by ultrafiltration, then acidifying the concentrated buttermilk to a pH below 4.0, adding the acidified buttermilk concentrate to cream having a predetermined fat content, the amount of said added concentrate being in the range of 5-15% of the amount of the cream, and neutralizing the mixture of buttermilk concentrate and cream.

30 EP 2996483 A (VALIO OY) relates to whippable milk product comprising milk fat from unhomogenized milk, protein, water-soluble calcium salt, at least one stabilizer and water. The pH of the milk product ranges between 5.5 and 7.

GB 2437239 A (LAKELAND DAIRY PROCESSING LTD) relates to a process for preparing a low fat whipping cream having 20% or less total fat by weight. The process comprises obtaining milk sufficient to provide between 70 and 80% by weight, adding milk powder and from 1 to 4% of cream to the milk and agitating. A starch and polysaccharide are added to the milk composition. A non-dairy lauric fat is melted at between 60 and 80 C. An emulsifier mix comprising monoglycerides and diglycerides of fatty acids, sorbitan monostearate, lactic acid ester and sodium stearyl lactylate is added to the non-dairy lauric fat to form a fat-emulsifier mix. A hydrocolloid mix of at least guar and carrageenan is added to either the milk composition or the fat-emulsifier mix before the aqueous and oily phases are combined, sterilised, homogenised and cooled. This final product contains non-dairy fat.

EP 0109372 A (SKANEMEJERIER EKONOMISK FORENI) relates to a process for the production of a low fat beatable cream (17-31% by weight of fat) having a shelf life of up to 8 weeks when kept in cold storage. The process comprises mixing a cream with sweet buttermilk and heating and tempering it by alternate heating and chilling and then heating the cream to at least 60°C. Then, the pH of the mixture is adjusted to about 5.95-6.25 by adding sour milk or sour buttermilk, whereupon the mixture is allowed to swell. After that, the mixture is homogenised, chilled, and sterilised or alternatively pasteurised. After the pasteurisation step, the mixture is again homogenized and chilled before being packaged.

US 3505077 (BRATLAND ARTHUR ET AL) relates to a recombined cream obtained by mixing a low fat milk fraction, a high fat milk fraction and water. The high fat milk fraction consists of any type of fat including butter or other glyceride fats such as palm kernel oil. The low fat fraction relates to skimmed milk and buttermilk. The low fat fraction may also be the remaining fraction obtained after removing the fat fraction of a concentrated cream. The document discloses that when using buttermilk or a buttermilk powder as addition, buttermilk may vary in its properties all according to the process used in churning. Variability of buttermilk properties appears as a limiting drawback for using it in whipped cream.

US 2015/099050 A (UMMADI MADHAVI ET AL) relates to a stable frozen confectionery product having improved organoleptic properties. The frozen confectionery product comprises a partially coagulated protein system including kappa-casein and beta-lactoglobulin and exhibits a pH comprised between 5.6 and 6.3 when melted and centrifuged at 50 000 g for 30 min at 25°C. The partially coagulated protein system is obtained by coagulating milk proteins through heat treatment in a mild acidic environment. More particularly, the frozen confectionery product is produced by homogenising, pasteurising between 178 and 190°F (80

to 87.7°C) for 30 to 90 seconds and then, freezing while aerating an ingredient mixture having a pH comprised between 5.6 and 6.3. The ingredient mixture comprises fat in an amount of 0-20% by weight, milk solids non-fat in an amount of 5-15%, a sweetening agent in an amount of 5-30%, a stabilizer system in an amount of 0-6% and optionally an acidic component. This document does not relate to chilled dairy product. Issues related to texture and stability are different between frozen and chilled dairy product. In particular, it is more difficult to stabilize a chilled dairy product while keeping a satisfactory texture over time.

The foregoing documents disclose dairy compositions which are ready for whipping. However, they do not address the issue of the shelf life of whipped dairy compositions.

Any reference to prior art documents in this specification is not to be considered an admission that such prior art is widely known or forms part of the common general knowledge in the field.

SUMMARY OF THE INVENTION

The object of the present invention is to improve the state of the art, and in particular to provide whipped cream composition, and a method for its manufacture, that overcomes the problems of the prior art and addresses the needs described above, or at least to provide a useful alternative.

The inventors were surprised to see that the object of the present invention could be achieved by the subject matter of the independent claims. The dependent claims further develop the idea of the present invention.

Accordingly, an embodiment of the invention proposes a method for the manufacture of a whipped cream composition, which comprises the steps of:

- providing a heat-treated acidified milk-based ingredient,
- mixing said ingredient with a cream component, and optionally with a stabilising system, to obtain a cream composition comprising 18 to 24 wt% of fat,
- heat-treating the cream composition at a temperature of from 120°C to 135°C, for a period of from 15 seconds to 1 minute, then cooling it, then storing it at a temperature of from 8°C to 15°C for a period of from 4 to 10 hours,
- aerating the heat-treated cream composition to obtain a whipped cream composition having an overrun of from 100% to 200%.

The inventors have found that using a heat-treated acidified milk-based ingredient compensates for the fat reduction in connection with both the foaming capacity of the cream

composition and the mouthfeel of the product. This was rather surprising as the cream compositions according to the invention have a higher protein content than standard whipped cream, which could lead to a grainy mouthfeel, which could also be reinforced by the lower fat content of the cream composition according to the invention.

5 The invention also proposes a method for the manufacture of a whipped cream composition, which comprises the steps of:

- providing a heat-treated acidified milk-based ingredient,
- mixing said ingredient with a cream component, and optionally with a stabilising system, to obtain a cream composition comprising 18 to 24 wt% of fat,
- 10 – heat-treating the cream composition at a temperature of from 120°C to 135°C, for a period of from 15 seconds to 1 minute, then cooling it, then storing it at a temperature of from 8°C to 15°C for a period of from 4 to 10 hours,
- aerating the heat-treated cream composition to obtain a whipped cream composition having an overrun of from 100% to 200% and a shelf life of up to 28 days at 4°C.

15 Another embodiment of the invention proposes a whipped cream composition obtainable by a method as outlined above. For instance, a whipped cream composition comprises 18 to 24 wt% of fat, having an overrun of from 100 to 200%, and a shelf life of 28 days at 4°C.

Another embodiment of the invention proposes a food product comprising at least
20 two different food layers, wherein one of said food layers comprises a whipped cream according to the invention.

These and other aspects, features and advantages of the invention will become more apparent to those skilled in the art from the detailed description of embodiments of the invention, in connection with the attached drawings.

25

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 shows pictures of freshly prepared whipped creams of Example 2.

Figure 2 shows the storage modulus (G') when measured according to the analytical methods described in the examples, of the whipped creams of Example 2 at different
30 overruns.

Figure 3 shows the overrun of the whipped cream compositions REF 1, REF4 and CREAM 3 of Example 4.

Figure 4 shows the storage modulus of the same whipped cream compositions.

DETAILED DESCRIPTION OF THE INVENTION

As used in the specification, the words “comprise”, “comprising” and the like are to be construed in an inclusive sense, that is to say, in the sense of “including, but not limited to”, as opposed to an exclusive or exhaustive sense.

5 As used in the specification, the word “about” should be understood to apply to each bound in a range of numerals. Moreover, all numerical ranges should be understood to include each whole integer within the range.

The terms “consists essentially of” mean that specific further components can be present, namely those not materially affecting the essential characteristics of the invention.

10 Unless noted otherwise, all percentages in the specification refer to weight percent, where applicable.

Unless defined otherwise, all technical and scientific terms have and should be given the same meaning as commonly understood by one of ordinary skill in the art to which this invention belongs.

15 The terms “whipped cream composition” or “whipped cream” refer to a cream composition in which gas bubbles have been introduced by whipping or aerating, in order to impart a foamy texture to the cream composition. The amount of gas introduced in the cream composition is measured by the overrun of whipped cream.

The terms “chilled” or “refrigerated” refer to a temperature ranging from about 3°C to
20 about 8°C, which is recommended for the conservation of a dairy product.

In a first aspect, the invention relates to a method for the manufacture of a whipped cream composition which has a low fat content, is stable over several weeks at refrigerated temperatures, and which has a similar mouthfeel as that of a standard full fat whipped cream.

25 Thanks to its lower fat content and higher overrun, such a whipped cream contributes to a lower fat and SFA intake, for a given volume or for a given weight of product, when compared to standard full fat whipped cream.

In a first step, the method comprises providing a heat-treated acidified milk-based ingredient. The heat-treated acidified milk-based ingredient may be provided as a liquid
30 concentrate or as powder. This ingredient helps to improve the texture of a low-fat whipped cream, as will be explained below, as well as how it is manufactured.

The heat-treated acidified milk-based ingredient is mixed with a cream ingredient and optionally with a stabilising system. Milk may also be mixed with the heat-treated acidified

milk-based ingredient and the cream ingredient. Milk may be provided as a liquid or as a powder, in which case a sufficient amount of water is added for reconstitution. Skimmed milk is preferred because it reduces the amount of fat added to the composition. A cream composition is obtained, which comprises 18 to 24 wt% of fat. The cream composition also comprises 2.5 to 4.0 wt% of protein. Additional details regarding the cream composition are provided below.

Cream is the dairy product which results from the separation of milk fat from raw milk. Cream is usually found as a suspension of fat globules in a plasma, which is an aqueous medium. Cream may comprise from 20 to 60 wt% of milk fat. Preferably, cream comprises 30 to 40 wt% of milk fat, such as about 34 wt%.

Milk may be skimmed milk, semi-skimmed milk, full fat milk, or buttermilk. Preferably, milk is skimmed milk, for the reason given previously. Preferably, milk is cow milk, although milk from other mammals may be used in the preparation of whipped cream. However, in the preparation of the heat-treated acidified milk-based ingredient, cow milk is preferred.

Preferably, the cream composition contains 50 to 65 wt% of cream (e.g. at 34% fat), 20 to 30 wt% of milk (liquid or after reconstitution in water), and 8 to 15 wt% of heat-treated acidified milk-based ingredient (liquid or after reconstitution in water). More preferably, the cream composition comprises 54 to 60 wt% of cream, 20 to 28 wt% of milk, such as skimmed milk, and 9 to 11 wt% of heat-treated acidified milk-based ingredient (for instance 1/3 heat-treated acidified milk-based ingredient powder reconstituted in 2/3 water).

As mentioned earlier, the cream composition comprises an optional stabilising system. The stabilising system may comprise gelatine, locust bean gum, pectin, guar, xanthan, carrageenan, alginate or a combination thereof. In an embodiment, the stabilising system comprises gelatine and locust bean gum. For instance, gelatine is graded 275 Bloom. The stabilising system may represent up to 1 wt% of the cream composition, preferably from 0.5 to 0.8 wt% of the cream composition.

Additional ingredients may be mixed into the cream composition, such as flavour agents or colour agents. Flavour agents include: sweetening agents, such a sugar, natural or artificial sweetening agents; as well as fruit flavours; spices and herbal flavours.

Preferably, the heat-treated acidified milk-based ingredient is provided as a dry powder. It is stirred into a suitable amount of water for rehydration. For instance, the heat-treated acidified milk-based ingredient is reconstituted in water to reach a total solids content of 25 to 40 %wt after reconstitution. Appropriate rehydration is necessary to ensure that milk

protein/fat aggregates are well reconstituted before mixing with the remaining ingredients of the cream composition. As will explained below, the milk protein/fat aggregates are generated by appropriate heat treatment of milk after pH adjustment to a mild acid pH. These aggregates contribute to mouthfeel. Also, the pH of the heat-treated acidified milk-based ingredient may be adjusted to a pH of from 6.4 to 6.8 where needed after reconstitution in water. By using the term "where needed", it is understood that, when the pH of the reconstituted heat-treated acidified milk-based ingredient is below 6.4, a food-grade alkali is added to increase the pH in the range of 6.4 to 6.8; conversely, when the pH of the reconstituted heat-treated acidified milk-based ingredient is above 6.8, a food-grade acid is added to reduce the pH in the range of 6.4 to 6.8.

The reconstituted heat-treated acidified milk-based ingredient is mixed with liquid milk, preferably skimmed milk, the stabilising system and cream. This leads to the cream composition which comprises 18 to 24 wt% of fat.

Afterwards, the cream composition is heat treated at a temperature of from 120°C to 135°C, for a period of from 15 seconds to 1 minute. This treatment reduces the bacterial load in the cream composition. The heat-treated cream composition is cooling and stored at a temperature of from 8°C to 15°C for a period of from 4 to 10 hours. This allows fat crystallisation. For instance, the heat-treated cream composition is stored overnight. Preferably, the cream composition is stored under stirring, such as cyclic stirring.

Then, the heat-treated cream composition is aerated to obtain a whipped cream composition having an overrun of from 100% to 200%. Preferably, the heat-treated cream composition is aerated to obtain a whipped cream composition having an overrun of from 100% to 200% and a shelf life of up to 28 days at 4°C.. Aeration may be performed in a MONDOMIX equipment. Preferably, aeration is performed in a continuous in-line rotor-stator whipping device as disclosed in WO 2013/068426 A1. For instance, aeration is performed using a neutral gas, such as nitrogen. At the pilot plant, working parameters of this equipment include a rotation speed of 500 to 1000 rpm, preferably from 650 to 900 rpm; and a nitrogen flow rate of 0.3 to 0.8 kg N₂/h, preferably from 0.4 to 0.7 kg N₂/h, for a cream composition (product) flow rate of 50 to 100 kg/h, preferably from 60 to 80 kg/h. The nitrogen flow rate is adapted to the cream composition flow rate, in order to inject enough gas to reach the target overrun. In industrial setting, the nitrogen flow rate is adapted to a cream composition flow rate of, for instance, 800 kg/h to 1 ton/hour.

Nitrogen is preferred over carbon dioxide. Indeed, carbon dioxide may impart an acidic taste to the product. Air may be used since it contains 80% nitrogen and the target shelf life of 28 days is short enough to have a minimal oxidation and off-taste.

5 The cream composition should not be homogenised after mixing of the heat-treated acidified milk-based ingredient with the cream component, because homogenisation destroy the protein aggregates of the heat-treated acidified milk-based ingredient and affect aeration stabilisation.

10 The heat-treated acidified milk-based ingredient is prepared by a process comprising the steps of:

- a) providing a liquid milk concentrate at a temperature below 25°C;
- b) adjusting the pH of said concentrate to 5.7 and 6.4;
- c) heat-treating the concentrate obtained at step (b) at a temperature from 80°C to 150°C for a period of 3 to 300 seconds;
- 15 d) cooling the heat-treated concentrate to a temperature below 70°C,
- e) optionally readjusting the pH of the concentrate obtained after step (c) or (d), to a pH of from 6.4 to 6.8
- f) optionally drying the concentrate obtained after step (d) or (e).

20 The terms "heat-treated acidified milk-based ingredient" refers to a milk composition which has been treated by performing a pH adjustment to a mildly acidic pH between 5.7 and 6.4, followed by a heat-treatment at a temperature from 80°C to 150°C for a period of 3 to 300 seconds.

25 The milk concentrate may be concentrated full fat milk, semi-skimmed milk or skimmed milk. Preferably it has a total solids of 30 to 50 wt%, for instance 35 to 45 wt%. For instance, the milk concentrate is homogenised before the pH readjustment. The milk concentrate is not buttermilk. Buttermilk is avoided because buttermilk properties may vary according to the churning method used. Using buttermilk could result in a cream composition which is very difficult to whip, in a whipped cream having bad organoleptic quality or in whipped cream with low stability over time. Moreover, it is difficult to reach a high overrun (overrun above 100%) with buttermilk and its use in whipped cream may lead to undesired
30 flavours.

The pH of the milk concentrate is adjusted to 5.7 and 6.4, by mixing a food grade acid therein, for instance citric acid, hydrochloric acid or phosphoric acid.

After pH adjustment, the concentrate is heat treated at a temperature from 80°C to 150°C for a period of 3 to 300 seconds, such as from 80°C to 100°C for 30 to 300 seconds, or such as from 130°C to 150° C for 3 to 15 seconds. Heat treatment can be done with standard heating equipment in the food industry, such as by direct steam injection.

5 After the heat treatment, the concentrate is cooled to a temperature below 70°C, for instance as low as 3°C.

Readjusting the pH of the concentrate may be needed for further use of the heat-treated acidified milk-based ingredient, for instance for mixing into a dairy composition. This step can be performed by mixing a food grade alkali into the heat-treated acidified milk-based concentrate, for instance NaOH.

10 Drying the heat-treated acidified milk-based ingredient can be done following standard drying processes in the food industry, such as spray drying or roller drying. The dried heat-treated acidified milk-based ingredient has a water content below 5%, preferably below 3%:

15 It was found that through control of pH in combination of controlled heat treatment (temperature and hold time), the whey proteins form complexes with the casein micelles, which results in increased colloidal particle size, water binding and overall viscosity.

Hence, it is possible to manufacture a heat-treated acidified milk-based ingredient comprising caseins and whey protein wherein the ingredient upon reconstitution in an aqueous medium comprises caseins and whey protein/fat aggregates having a mean diameter value Dv50 of at least 1 µm as measured by laser diffraction.

20 The term “particles having mean diameter value Dv50” refers to protein network comprising casein micelles and whey proteins either present in aggregates together with fat. The term “aggregates” refers to the structure formed by the aggregation of the whey proteins with casein micelles and fat droplets. By the term “aggregation” it is meant that the proteins and the fat droplets are in contact and form together a 3D network. These protein aggregates form a network that is suspected of binding water and entrapping fat globules (in case of presence of fat) and increases mix viscosity to create a uniquely smooth, creamy texture that mimics the presence of higher fat levels.

30 The mean diameter value Dv50 of the heat-treated acidified milk-based ingredient ranges from 1 µm - 60 µm. For instance, the Dv50 value ranges from 2 µm - 25 µm. Also for instance, the Dv50 value ranges from 3 µm - 20 µm. Also for instance, the Dv50 value ranges from 5 µm - 10 µm.

The term “upon reconstitution in an aqueous medium” refers to reconstituting the heat-treated acidified milk-based ingredient into a liquid such as water. The liquid may be milk.

It has surprisingly been found that the heat-treated acidified milk-based ingredient
5 may be used to enhance texture and mouthfeel of whipped cream.

In another aspect, the invention relates to a whipped cream composition obtainable by a method as described above. Such a whipped cream composition comprising 18 to 24 wt% of fat, having an overrun of from 100 to 200%, and a shelf life of 28 days at 4°C. The overrun and the shelf life are measured as explained in the analytical methods in the examples.

10 The term “a whipped cream having a shelf life of up to 28 days at 4°C” or “stable whipped cream” refers to a whipped cream essentially preserving its initial organoleptic and rheology features after a time of up to 28 days at a temperature of 4°C. More specifically, the whipped cream keeps the same texture as defined above and exhibits a limited loss of overrun, i.e. a loss of overrun below 10% over shelf life. Furthermore, it exhibits no or limited
15 syneresis or other foam destabilisation clues (e.g volume loss) after a time up to 28 days at a temperature of 4°C. Preferably, the whipped cream composition has an overrun of 110 to 190%, such as from 120 to 180%, and more preferably from 140 to 170%. At this level of overrun, it is considered that the whipped cream composition exhibits similar texture and mouthfeel as a standard full fat whipped cream. In connection with whipped cream, “full fat”
20 shall mean about 26 wt% of fat.

In an embodiment, the whipped cream composition comprises 18 to 24 wt% of fat, preferably from 19 to 22 wt% of fat, such as about 20 wt% of fat. Preferably, the whipped cream composition comprises up to 15 wt% of saturated fatty acids, such as 10 to 15 w% SFA. In an embodiment, the fat in the whipped cream composition comprises milk fat. Non-milk fat
25 may be included in the whipped cream composition, but this is not a preferred option due to regulatory constraints and consumer acceptance. Therefore, it is preferred that the fat consists essentially of milk fat. Even more preferably, the cream composition does not contain non-milk fat.

In an embodiment, the whipped cream composition comprises 2.5 to 4.0 wt% of
30 protein, preferably from 3.1 to 3.8 wt% of protein, such as 3.2 to 3.5 wt% of protein. Non-dairy proteins can also be considered, such as soy proteins or other vegetable proteins. However, it is preferred that proteins consists essentially of milk proteins.

The whipped cream composition may also comprise sugars, such as lactose from the dairy-based ingredients, or added sugars, such as sucrose. Preferable, the whipped cream composition comprises up to 15wt% of sugar, including for instance as from 5 to 10 wt% of sucrose.

5 The whipped cream composition further comprises an optional stabilising system, as described above.

 The whipped cream composition described above may be used in the manufacture of desserts or other food products, such as multi-layered food products. Hence, an aspect of the invention is a food product comprising at least two different food layers, wherein one of said
10 food layers comprises a whipped cream composition as described before. Preferably, the layer of whipped cream composition is a top layer, optionally sprinkled with particles. In a dessert, the particles are preferably confectionery particles, such as nut pieces, chocolate chips, or biscuit crumbs for instance. In a savoury dish, the particles can be nut pieces, herbs, spices, or fried onion pieces for instance.

15 For instance, the food product comprises at least one bottom layer different from the whipped cream composition layer. The bottom layer may comprise for instance a crème dessert, a fermented dairy product, a fresh cheese, a mousse (for instance, a chocolate mousse) or a fruit-based composition. An example of a dessert is a liégeois-type dessert, which comprises a bottom layer of chocolate crème dessert with a topping of whipped cream.

20

 Those skilled in the art will understand that they can freely combine all features of the present invention disclosed herein. Further, features described for different embodiments of the present invention may be combined.

 Furthermore, where known equivalents exist to specific features, such equivalents are
25 incorporated as if specifically referred in this specification. Further advantages and features of the present invention are apparent from the figures and non-limiting examples.

EXAMPLES

Analytical methods

30 *Brookfield viscosity*

 Viscosity was measured using a Brookfield viscometer. A rotating spindle (N°92) was used at rotation speed of 5 rpm on cream compositions at 8°C. Each sample was analysed one

day after production, before whipping, and each analysis was repeated three times in order to get standard deviation.

The measurement was done directly in the cup at three different heights (top, middle and bottom) in order to take into account the texture differences which might occur.

5 This analysis can relate to the texture of the cream composition.

Foam overrun

The term “overrun” refers to the increase in volume of the cream composition. It is also referred to as a “foaming capacity”. The overrun (OR) is calculated according to the following equation:

10
$$OR = \frac{Va - Vb}{Vb} \times 100$$

where Vb is the volume of a predetermined weight of the cream composition before aeration and Va is the volume of the same weight of whipped cream composition, ie after aeration or whipping.

The overrun was measured immediately after whipping.

15 *Foam texture – Rheology / Oscillometry*

The texture of whipped cream was analysed using a Anton Paar MCR 101 rheometer, applying small amplitude oscillations (amplitude sweep from 0,01% to 500% strain, shear stress range from 0,01 to 110 Pa, frequency of 1 Hz) with a sanded 50mm plate-plate configuration and a gap of 1mm, at 8°C. G' (storage modulus) and G'' (loss modulus) were
20 captured in the linear range.

Shelf life

Shelf life is measured by storing the freshly made whipped cream or dessert (see example 3) for a period of up to 35 days under a controlled temperature of 4°C. Samples of stored products are inspected visually to observe whether there is a loss of texture, such as
25 syneresis or foam destabilisation. Observations may be performed, after 1 day, 8, 14, 21, 28 and 35 days of storing. Microbial stability is checked by analysing the total micro-organism count and enterobacteriae count. The total micro-organism count must be below 10 cfu/g and the enterobacteriae count must be below 10 cfu/g, after storage under a temperature of 4°C. cfu = colony forming unit.

Example 1*Reference 1 – Skimmed Milk Powder (SMP)*

This reference skimmed milk powder is a commercial ingredient from EPI Ingredients (Ancenis, France) with the following composition: 34% proteins, 1% fat, 2% lactose, 96% dry matter, 8.2% ash. Process conditions are unknown. Hence another reference was used as described below.

Reference 2 – Full Fat Milk Powder

Raw milk (protein, N x 6.38) 3.4%, fat 4.0%, total solids 12.8% is preheated to 60°C in a plate heat exchanger and homogenized in a Gaulin MC 15 100TBSX high pressure homogenizer (250 bars). Subsequently, the homogenized milk is concentrated in a Scheffers 3 effects falling film evaporator (from Scheffers B.V.) to 35% total solids. The milk concentrate is cooled in a plate heat exchanger to 4°C. The pH of the homogenized liquid milk concentrate was measured to be 6.5. The composition is preheated again to 60°C in a plate heat exchanger and subsequently heated to 85°C in a direct steam injection system (self-construction of Nestlé) with a holding time of 15 seconds. After the heat treatment, the milk concentrate is rapidly cooled down in a 3VT460 CREPACO scrape heat exchanger (from APV Invensys Worb) to 40°C. The milk concentrate is then spray dried in a 3.5 m spray-drier (self-construction of Nestlé) with a two-phase nozzle system (1.8 mm nozzle) to a maximal moisture content of 3% and packed into air tight bags. Conditions of spray drying were: product flow of 413 kg/h at 37°C product temperature, hot air inlet temperature of 270°C and an air flow of 4664 kg/h, outlet air temperature of 88°C.

Heat-treated Acidified Full Fat Milk Powder

Raw milk (same composition as Reference 2) is preheated to 60°C in a plate heat exchanger and homogenized in a Gaulin MC 15 100TBSX high pressure homogenizer (250 bars). Subsequently, the homogenized milk is concentrated in a Scheffers 3 effects falling film evaporator (from Scheffers B.V.) to approximately 35% total solids. The milk concentrate is cooled in a plate heat exchanger to 4°C. The pH of the milk concentrate is adjusted to 6.0 using citric acid. The pH-adjusted milk concentrate is preheated again to 60°C in a plate heat exchanger and subsequently heated to 95°C in direct steam injection system (self-construction of Nestlé) with a holding time of around 150 seconds. After the heat treatment, the milk concentrate is rapidly cooled down in a 3VT460 CREPACO scrape heat exchanger (from APV Invensys Worb) to 40°C. The milk concentrate is then spray dried in a NIRO SD6 3N spray dryer with a rotary disc nozzle system at 17,000 rpm to a maximal moisture content of 3% and

packed into air tight bags. Conditions of spray drying were: product flow of 20 L/h at 40°C product temperature, hot air inlet temperature of 160°C and an air flow of 360 m³/h, outlet air temperature of 80°C.

The heat-treated acidified full fat milk powder contains 27% milk fat, 26% milk proteins, 38% lactose, 97% dry matter, 6% ash.

Example 2 – Whipped Cream

Cream Compositions

A first reference cream composition was prepared with the skimmed milk powder (Reference 1) as follows. Liquid dairy cream (34% milk fat, 1.9% protein) and liquid skimmed milk were mixed together at a temperature of 10°C. Then skimmed milk powder (Reference 1), gelatine and locust bean gum (LBG) were dissolved into the milk and cream mixture. The pH of the mix was measured as 6.53 and adjusted with NaOH solution 30% to pH 6.6. The mix was UHT heat treated (130°C/30 sec) and stored overnight at 10°C under cyclic stirring in order to allow fat crystallisation. The first reference cream composition has a fat content of 26%. See Table 1, R1.

A second reference cream composition was prepared with the full fat milk powder (Reference 2) as follows. The full fat milk powder was first stirred with a suitable amount of water to ensure complete rehydration. The reconstituted powder was then mixed into liquid skimmed milk, stabilizers (gelatine and LBG) and a liquid dairy cream (34% fat). The pH of the mix was measured to be 6.6. The mix was then UHT heat treated (130°C/30 sec at pH 6.6) and stored overnight at 10°C under cyclic stirring in order to allow fat crystallisation. The second reference cream composition has a fat content of 20%. See Table 1, R2.

A third cream composition was prepared in the same way as the second reference cream composition above, except that the full fat milk powder (Reference 2) was replaced with the heat-treated acidified full fat milk powder of Example 1. The third cream composition has a fat content of 20%. See Table 1, C3.

Nutritional analysis of the cream compositions are reported in Table 2. Cream compositions R2 and C3 have a higher protein content than that of the reference cream composition R1. They also have lower fat and SFA contents, lower energy density and more calcium than the reference cream composition R1. Carbohydrate and sugar contents are comparable.

Table 1 – Cream compositions ingredients (in % by weight)

	Reference cream composition 1 (R1)	Reference cream composition 2 (R2)	Cream composition 3 (C3)
Liquid cream, 34% fat	76.72	56.70	56.70
Liquid skimmed milk	14.12	24.65	24.65
Water	-	7.53	7.53
Milk Powder (from Example 1)	Reference 1 1.42	Reference 2 3.38	Heat-treated Acidified Full Fat Milk Powder 3.38
Sugar	7.00	7.0	7.0
Gelatine	0.70	0.7	0.7
Locust Bean Gum	0.04	0.04	0.04
Total	100	100	100

Table 2 – Nutritional analysis (in % by weight)

	Reference cream composition 1 (R1)	Reference cream composition 2 (R2)	Cream composition 3 (C3)
Protein content (%)	3.0	3.4	3.4
Fat content (%)	26.1	20.2	20.2
SFA content (%)	17.0	13.2	13.2
Carbohydrate (%)	10.6	11.0	11.0
Sugars (%)	10.5	11.0	11.0
Energy (kcal/100g)	333	267	267
Calcium (mg/100g)	90.6	122	122

5 Whipping

The cream compositions were aerated in a continuous in-line rotor-stator whipping device as disclosed in WO 2013/068426 A1. Whipping parameters are reported in Table 3 below. Foam stability was assessed visually over 1 month of storage at 10°C. It is reported in Table 3, together with the overrun of the whipped cream compositions. Foam texture was analysed using an Anton Paar rheometer, as explained in the description of the analytical methods.

For the first reference cream composition (R1), a first reference whipped cream having an overrun between 150% and 200% was obtained by varying the rotation speed from 300 rpm to 650 rpm and the nitrogen flow rate from 0.15 to 0.50 kg/hour. The cream composition was injected in the whipping device at a flow rate of 70 kg/hour.

- 5 For the second reference cream composition (R2), a second reference whipped cream having an overrun between 150% and 200% was obtained by varying the rotation speed from 650 to 900 rpm and the nitrogen flow from 0.5 to 0.7 kg/hour. The cream composition was injected in the whipping device at a flow rate of 70 kg/hour.

- 10 For the cream composition prepared with the heat-treated acidified full fat milk powder (C3), a stable whipped cream with on overrun between 140% and 170% was obtained at a rotation speed of 900 rpm and by varying the nitrogen flow between 0.15 and 0.60 kg/hour. The cream composition was injected in the whipping device at a flow rate of 70 kg/hour.

- 15 Table 3 – Whipping parameters and whipped cream assessments

	Trial #	R1.1	R1.2	R2.1	R2.2	R2.3	C3.1	C3.2	C3.3
Cream composition	Table 1	R1	R1	C3	C3	C3	R2	R2	R2
Rotation speed	rpm	300	650	300	650	900	300	900	900
Nitrogen flow rate	kg/h	0.127	0.500	0.150	0.500	0.680	0.150	0.150	0.600
Product flow rate	kg/h	70	70	70	70	70	70	70	70
Overrun	%	144	200	122	150	200	126	146	170
Foam stability		stable	stable	liquid	stable	stable	liquid	stable	stable

- 20 Pictures of whipped creams are provided on Figure 1. Figure 2 shows the storage modulus (G') of some of the whipped creams of Example 2 at different overruns. As expected the reference whipped cream composition with 20% fat (R2) had less texture compared to the full fat whipped cream composition at 26% fat (R1). For the same fat content, increasing overrun (i.e. incorporation of a higher amount of nitrogen) results in higher G' values i.e.

firmer foams (Figure 2). Surprisingly the foamed structures generated at higher overruns are not fragile, they remain stable over 1 month in chilled conditions. No syneresis was observed. Whipping at an overrun higher than the usual value of 120% enhances the firmness and the structure stability.

5

Example 3 – Dessert Cream with a Whipped Cream Topping

The reference whipped cream compositions R2.2 and R2.3 and the whipped cream compositions C3.2 and C3.3 were used to manufacture a dessert with a bottom layer of chocolate cream and a top layer of whipped cream similar to the commercial product Nestlé Viennois Chocolat. The resulting desserts were compared with the commercial product Nestlé Viennois Chocolat. The latter is prepared with a full fat whipped cream similar to trial R1.1 of Example 2, but with an overrun of 120% only. The comparison was performed by a sensory panel of 10 trained panellists, after 14 days of storing at 8°C.

The panellists found that the whipped cream of the desserts prepared with compositions C3.2 and C3.3 had a firmer and thicker composition, when compared with the commercial product, that it was “more noisy” when spooning it, and that it provided a stronger fat coating mouthfeel.

They also found that the whipped cream of the desserts prepared with compositions C3.2 and C3.3 had a better fat coating mouthfeel and a less grainy perception, than the reference whipped cream compositions R2.2 and R2.3.

Example 4 – Comparison Between Several Whipping Equipments

A cream composition comprising 26 wt% fat was prepared with the heat-treated acidified full fat milk powder of example 1, and it was whipped with a MONDOMIX device. This cream composition (REF 4 in Figures 3 and 4) comprises 74 wt% cream (34 wt% fat), 8.1 wt% liquid skimmed milk, and the same amount of heat-treated acidified full fat milk powder (Example 1), water, sugar, gelatine and locust bean gum as the cream composition C3 (see Table 2). This whipped cream was compared a whipped cream prepared with the reference cream composition REF1 and with a whipped cream prepared with the cream composition C3 (see Table 2), and both whipped with the continuous in-line rotor-stator whipping device as disclosed in WO 2013/068426 A1.

The following MONDOMIX whipping parameters have been used: rotation speed of 300-350 rpm and nitrogen flow rate between 60 and 75 litres/hour in the standard working conditions of the MONDOMIX apparatus.

5 Results are reported in Figures 3 and 4. It was found that increasing the rotation speed to 600 or 900 rpm did not result in an overrun increase, contrary to what was observed with the continuous in-line rotor-stator whipping device mentioned above.

In Figures 3 and 4, MX stands for MONDOMIX whipping device, and NW stands for in-line rotor-stator whipping device as disclosed in WO 2013/068426 A1. REF 1 and CREAM 3 correspond to R1 and C3 of Table 2.

10 Figure 3 shows the overrun of the whipped cream compositions REF 1, REF4 and CREAM 3. Figure 4 shows the storage modulus of the same whipped cream compositions.

Although the invention has been described by way of example, it should be appreciated that variations and modifications may be made without departing from the scope
15 of the invention as defined in the claims.

CLAIMS

1. A method for the manufacture of a whipped cream composition , which comprises the steps of:

- 5 – providing a heat-treated acidified milk-based ingredient,
 – mixing said ingredient with a cream component, and optionally with a stabilising system, to obtain a cream composition comprising 18 to 24 wt% of fat,
 – heat-treating the cream composition at a temperature of from 120°C to 135°C, for a period of from 15 seconds to 1 minute, then cooling it, then storing it at a temperature of from 8°C
10 to 15°C for a period of from 4 to 10 hours,
 – aerating the heat-treated cream composition to obtain a whipped cream composition having an overrun of from 100% to 200%

2. A method according to claim 1, wherein the heat-treated acidified milk-based
15 ingredient is prepared by a process comprising the steps of:

- a) providing a liquid milk concentrate at a temperature below 25°C;
b) adjusting the pH of said concentrate to 5.7 and 6.4;
c) heat-treating the concentrate obtained at step (b) at a temperature from 80°C to 150°C for a period of 3 to 300 seconds,
20 d) cooling the heat-treated concentrate to a temperature below 70°C,
e) optionally readjusting the pH of the concentrate obtained after step (c) or (d), to a pH of from 6.4 to 6.8
f) optionally drying the concentrate obtained after step (d) or (e).

25 3. A method according to any one of claim 1 or 2, which comprises the steps of, prior to mixing the heat-treated acidified milk-based ingredient with said cream component,

- if said ingredient is dry, reconstituting it in water, to a total solids of 25 to 40% after reconstitution, and,
– readjusting the pH of said ingredient to a pH of from 6.4 to 6.8, where needed.

30

4. A method according to any one of claims 1 to 3, wherein said cream component comprises 30 to 40 wt% of milk fat.

5. A whipped cream composition obtainable by a method according to any one of claims 1 to 4 comprising 18 to 24 wt% of fat, having an overrun of from 100 to 200%, and a shelf life of 28 days at 4°C .

5 6. The whipped cream composition according to claim 5, which comprises 2.5 to 4.0 wt% of milk protein.

7. The whipped cream composition according to claim 5 or 6, wherein the fat consists essentially of milk fat.

10

8. The whipped cream composition according to any one of claims 5 to 7, wherein the whipped cream further comprises a stabilising system.

9. The whipped cream composition according to claim 8, wherein the stabilising system
15 comprises gelatine, locust bean gum, pectin, guar, xanthan, carrageenan, alginate or a combination thereof.

10. A food product comprising at least two different food layers, wherein one of said food layers comprises a whipped cream composition according to any one of claims 5 to 9.

20

11. A food product according to claim 10, wherein said layer of whipped cream composition is a top layer, optionally sprinkled with confectionery or savoury particles.

12. A food product according to claim 11, comprising at least one bottom layer which
25 bottom layer comprises a crème dessert, a fermented dairy product, a fresh cheese, a mousse different from said whipped cream, or a fruit-based composition.

30

1 / 2

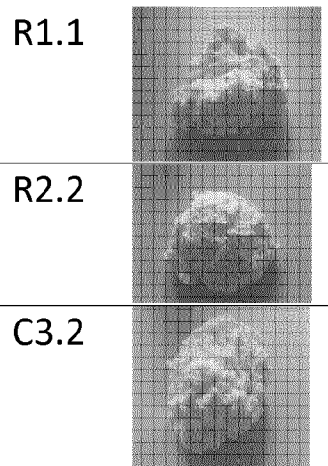


FIGURE 1

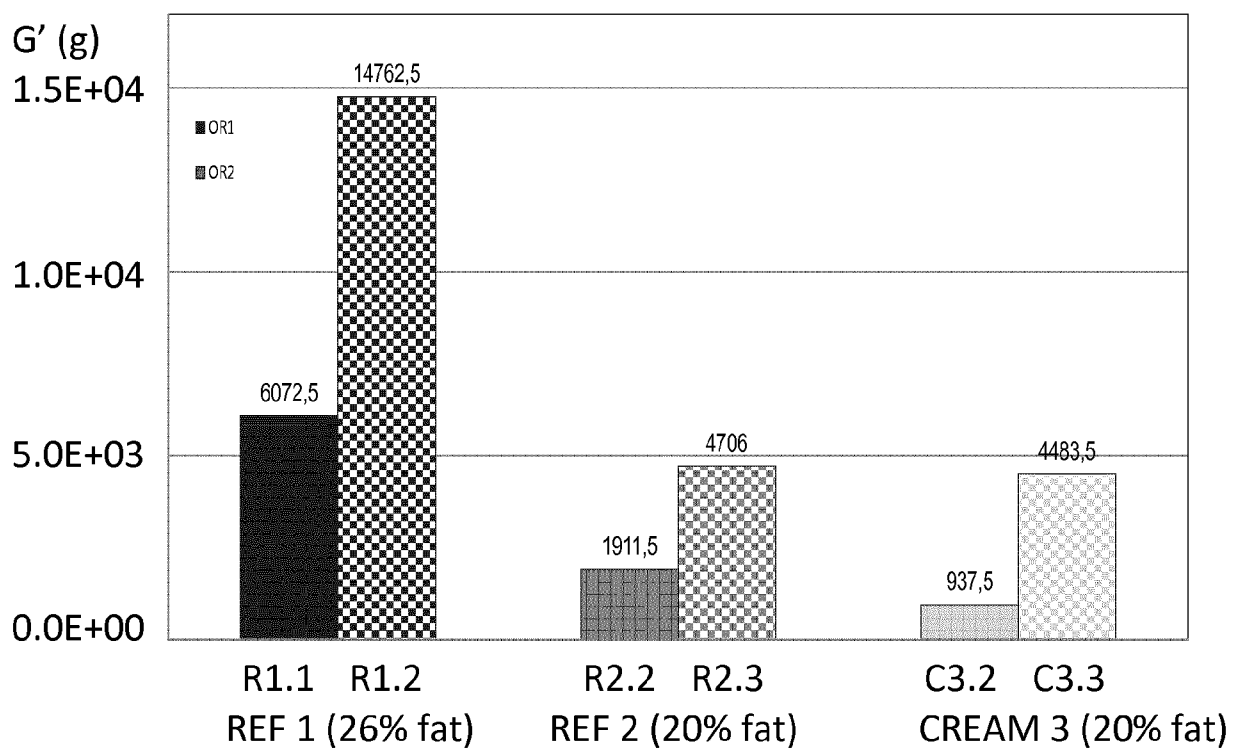


FIGURE 2

2 / 2

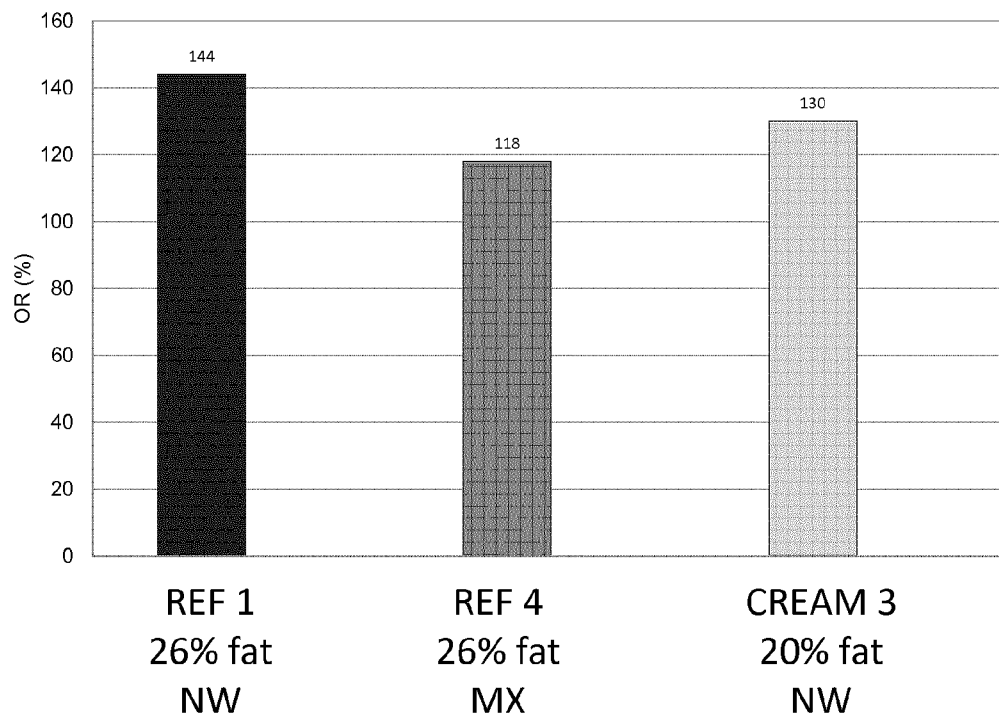


FIGURE 3

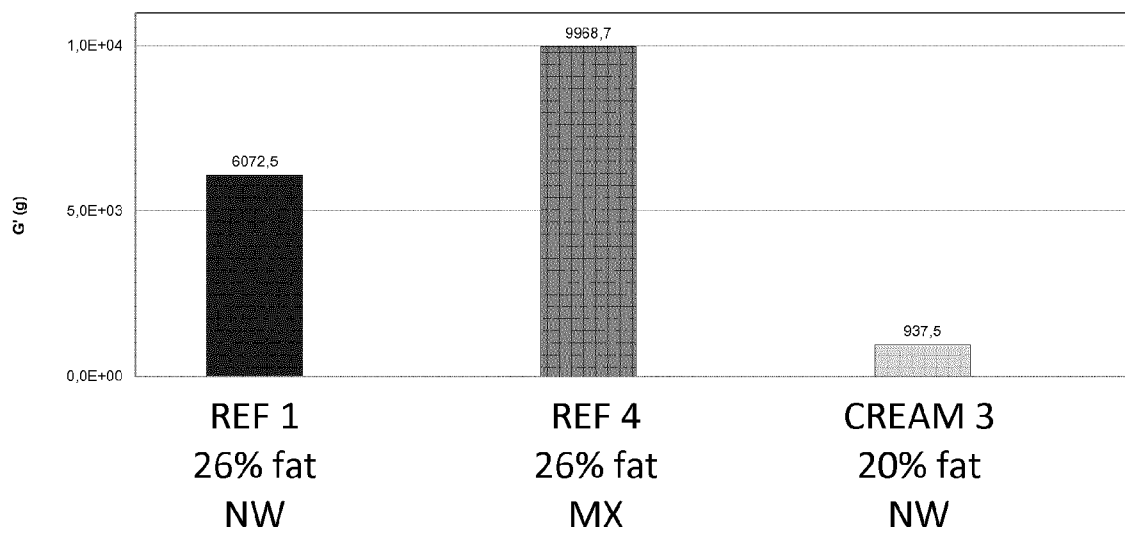


FIGURE 4

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2017/065996

A. CLASSIFICATION OF SUBJECT MATTER

INV. A23C13/12 A23C13/14 A23C9/152 A23C13/08 A23L19/00
A23L33/20 A23P20/10 A23P20/20 A23G3/34 A23G3/46
A23G3/52 A23G3/54 A23G3/56 A23C19/076 A23C9/154

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

A23C A23L A23P A23G

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-Internal, FSTA, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

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Further documents are listed in the continuation of Box C.



See patent family annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

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"&" document member of the same patent family

Date of the actual completion of the international search

17 July 2017

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INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2017/065996

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
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