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(54) Title: A CONFECTIONERY PRODUCT COMPRISING A LIPID-FIBRE POWDER

(57) Abstract: The invention relates to a manufacturing process for the production of a fat-based confectionery comprising a lipid-fibre powder.

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A CONFECTIONERY PRODUCT COMPRISING A LIPID-FIBRE POWDER

TECHNICAL FIELD

The invention relates to a manufacturing process for the production of a fat-based confectionery product comprising a lipid-fibre powder. In particular the invention relates to the use of a lipid-fibre powder having between 30 to 80wt% of oil or fat (by weight of total lipid-fibre powder) and 20 to 70wt% of a fruit and/or vegetable fibre (by weight of total lipid-fibre powder), wherein the fibre is characterized by having a rate of hydration between 15 to 500 cP/min and preferably wherein the oil or fat has a solid fat content (SFC) at 20°C below 12 wt%.

BACKGROUND

Fats and oils are often added in foods to provide nutrition, taste/aroma, texture, specific processing role, and/or to drive consumers liking. Current trends are toward healthier fats; usually reflected in lower SFA, TFA, and minimally processed (e.g. non-hydrogenated, non-interesterified) fats or oils. Replacing hard fats e.g. with healthier oils is however not trivial. Issues in processing or consumer-related complains may arise.

In particular, for chocolate products, modification of the fat used may lead to issues in bloom stability and oiling out. The issue of bloom can lead to consumers considering a product to no longer be able and can lead to sustainability issues.

In addition, there is a nutritional trend to avoid or at least reduce consumption of fats rich in trans-fatty acids and saturated fatty acids and to preferably consume healthy oils rich in monounsaturated fatty acids and/or polyunsaturated fatty acids such as sunflower, safflower, rapeseed and/or olive oil, for example.

Hence, it was the object of the present invention to provide the art with a manufacturing process for the production of a solid lipid-fibre powder containing healthier fats. This solid lipid-fibre powder is used for the preparation of fat-based confectionery.

SUMMARY OF THE INVENTION

The object of the present invention is to improve the state of the art or at least provide an alternative for a fat-based confectionery containing healthier fats and oils:

- i) the powdered lipid-fibre has a good flow-ability with flow-ability index (FFC) above 1.8 at 23°C;
- ii) incorporate healthier lipid in a higher amount (more than 5 wt%) in a fat-based confectionery product without bloom or oiling out;
- iii) avoid the usage of hydrogenated or interesterified oils and fats;
- iv) use a powdered lipid which seems stable against rancidity;
- v) preferably no added emulsifier or added protein needed;
- vi) the powdered lipid-fibre keeps a powdered structure even at high temperature e.g. up to 120°C;
- vii) improve dosing accuracy;
- viii) better distribution of the powdered lipid-fibre of the invention during mixing with other ingredients;

- ix) no lump by same mixing parameters with other ingredients (batch size, speed and time; and
- x) a reduction in oiling out and/or bloom stability.

The object of the present invention is achieved by the subject matter of the independent claims. The dependent claims further develop the idea of the present invention.

Accordingly, the present invention provides in a first aspect a process for the production of a fat-based confectionery comprising a lipid-fibre powder comprising between 30 to 80wt% of an oil or fat (by weight of total lipid-fibre powder) and 20 to 70wt% of a fibre (by weight of total lipid-fibre powder), the process comprising the steps of:

- a) Mixing fibre, oil or fat, and water at a weight ratio of fibre to water between 1:2.5 and 1:30;
- b) Drying the mixture of step a);
- c) Optionally milling the lipid-fibre powder after the drying step b);

wherein the fibre is characterized by having a rate of hydration between 15 to 500 cP/min and preferably wherein the oil or fat has a solid fat content (SFC) at 20°C below 12 wt%.

In a second aspect of the invention, there is provided a fat-based confectionery product obtainable by process comprising the production of a lipid-fibre powder having between 30 to 80 wt% of an oil or fat (by weight of total lipid-fibre powder) and 22 to 60wt% of a fibre (by weight of total lipid-fibre powder) comprising the steps of:

- a) Mixing fibre, oil or fat, and water at a weight ratio of fibre to water between 1:2.5 and 1:30;
- b) Drying the mixture of step a);
- c) Optionally milling the lipid-fibre powder after the drying step b);

wherein the fibre is characterized by having a rate of hydration between 15 to 500 cP/min and preferably wherein the oil or fat has a solid fat content (SFC) at 20°C below 12 wt%.

It has been surprisingly found by the inventors that by the process of the invention a lipid-fibre powder comprising between 30 to 80% of oil or fat (by weight of total lipid-fibre powder) and 20 to 70wt% of fibre (by weight of total lipid-fibre powder), wherein the fibre is characterized by having a rate of hydration between 15 to 500 cP/min, can be obtained which can now solve the requirement to achieve the necessary attributes:

- incorporate healthier lipid in a higher amount (more than 5 wt%) in a food product having good flow-ability and without oil-staining;
 - the powdered lipid-fibre of the invention has good flow-ability (FFC above 1.8 at 23°C);
 - preferably no added emulsifier or added protein needed;
 - keeps a powdered structure even at high temperature e.g. up to 120°C;
 - the powdered lipid-fibre seems stable against rancidity;
 - improved dosing properties and no caking;
- no structuring agents are needed to reach a good flow-ability; and
- reduction in oiling out and bloom.

DETAILED DESCRIPTION

The present invention pertains to a process for the production of a lipid-fibre powder comprising between 30 to 80wt% of an oil or fat (by weight of total lipid-fibre powder) and 20 to 70wt% of a fibre (by weight of total lipid-fibre powder), the process comprising the steps of:

- a) Mixing fibre, oil or fat, and water at a weight ratio of fibre to water between 1:2.5 and 1:30;
- b) Drying the mixture of step a);
- c) Optionally milling the lipid-fibre powder after the drying step b);

wherein the fibre is characterized by having a rate of hydration between 15 to 500 cP/min and preferably wherein the oil or fat has a solid fat content (SFC) at 20°C below 12 wt%.

“Lipid-fibre powder” according to this invention preferably has a particle size distribution with a median diameter Dv_{50} in the range of 15 to 5000 μm , preferably in the range of 20 to 5000 μm , preferably in the range of 30 to 3000 μm , preferably in the range of 30 to 1500 μm , preferably in the range of 40 to 1500 μm , preferably in the range of 40 to 1000 μm , preferably in the range of 50 to 1000 μm , preferably in the range of 80 to 1000 μm , preferably in the range of 80 to 700 μm , preferably in the range of 100 to 700 μm , preferably in the range of 150 to 700 μm , preferably in the range of 150 to 500 μm .

In a further embodiment “lipid-fibre powder” according to this invention has a water activity below 0.50, preferably below 0.40, preferably below 0.35, more preferably below 0.30, more preferably below 0.25, more preferably below 0.20.

The particle size Dv_{50} is used in the conventional sense as the median of the particle size distribution. Median values are defined as the value where half of the population resides above this point, and half resides below this point. The Dv_{50} is the size in microns that splits the distribution with half above and half below this diameter. The particle size distribution may be measured by laser light scattering, microscopy or microscopy combined with image analysis. For example, the particle size distribution may be measured by laser light scattering. Since the primary result from laser diffraction is a volume distribution, the Dv_{50} cited is the volume median.

“Oil or fat” of the present invention preferably has a solid fat content (SFC) at 20°C below 12 wt%, preferably has a solid fat content (SFC) at 20°C between 0 to 12 wt%, preferably has a solid fat content (SFC) at 20°C between 0 to 10 wt%, preferably has a solid fat content (SFC) at 20°C between 0 to 8 wt%, preferably has a solid fat content (SFC) at 20°C between 0 to 6 wt%. The oil or fat of the present invention preferably has a solid fat content (SFC) at 20°C below 6 wt%. Oil is liquid at a temperature of 25°C, preferably at a room temperature of 20°C. Sunflower oil has a solid fat content (SFC) at 20°C of 0. Olive oil has a solid fat content (SFC) at 20°C of 0. Palm fat has a solid fat content (SFC) at 20°C between 20 to 65. The solid fat content shows that according to the invention palm fat is excluded as it is solid at a temperature of 25°C, preferably at room temperature of 20°C.

In a preferred embodiment the oil or fat is selected from the group consisting of sunflower oil, rapeseed oil, linseed oil, flaxseed oil, cotton seed oil, primrose oil, peanut oil, soy oil, olive oil, insect fat, algal oil, safflower oil, corn oil, rice bran oil, sesame oil, hazelnut oil, avocado oil, almond oil, walnut oil, hemp oil, macadamia, other nut oils, cardamom oil, coffee oils, pumpkin seed oil, argan oil, grapeseed oil or a combination thereof.

The above oils may be optionally hydrogenated (partially or fully) and optionally inter-esterified. However, it is preferred to not process the oils from a consumer view point.

Optionally, the oil can contain one or more liposoluble compounds; such as for example plant polyphenols, fatty acids, such as n-3 fatty acids, n-6 fatty acids, vitamins, aromas, flavours, antioxidants, other active ingredients. Preferred antioxidants include ascorbic acid, ascorbyl palmitate, citric acid, rosmarin extract, BHA (Butylated hydroxyanisole), BHT (Butylated hydroxytoluene), mixed tocopherol, and EDTA (Ethylenediaminetetraacetic acid).

The above liquid oils may have differing oleic acid contents. For example, sunflower oil may be (% by weight): Conventional oil or high linoleic acid: $14.0\% < \text{Oleic acid} < 43.1\%$, Mid Oleic: $43.1\% \leq \text{Oleic acid} < 71.8\%$, High oleic: $71.8\% \leq \text{Oleic acid} < 90.7\%$, Ultra/Very-high oleic, $90.7\% \leq \text{oleic acid}$. For example, safflower oil: conventional oil: $8.4\% < \text{Oleic acid} < 21.3\%$; and High oleic: $70.0\% < \text{Oleic acid} < 83.7\%$. Additionally, high oleic acid variants of the following oils are available, soybean oil ($70.0\% \leq \text{Oleic acid} < 90.0\%$), rapeseed oil ($70.0\% \leq \text{Oleic acid} < 90.0\%$), olive oil ($70.0\% \leq \text{Oleic acid} < 90.0\%$), canola ($70.0\% \leq \text{Oleic acid} < 90.0\%$), and algae oil ($80.0\% \leq \text{Oleic acid} < 95.0\%$).

In other embodiments, the liquid oil may be medium-chain triglycerides, preferably triglycerides where the fatty acids have an aliphatic tail of 6–12 carbon atoms. These oils may be obtained from coconut oil, palm kernel oil or milk.

In a further embodiment, the lipid-fibre powder comprises oil or fat in an amount in the range of 40 to 78% (by weight of the lipid-fibre powder), preferably between 45 to 78%, preferably between 50 to 78%, 55 to 78%, 60 to 78% (by weight of the lipid-fibre powder). For example, between 30 to 60% by weight of the powder is oil or fat.

“Fibre” according to this invention is characterized by having a rate of hydration between 15 to 500 cP/min, preferably 25 to 400 cP/min, preferably 50 to 350 cP/min. The cP/min can be recalculated to cP/sec and $1 \text{ cP} = 10^{-3} \text{ Pa}\cdot\text{s}$. In a preferred embodiment fibre having a rate of hydration between 0.250 to 8.333 cP/sec, preferably 0.417 to 6.666 cP/sec, preferably 0.833 to 5.833 cP/sec.

“Rate of hydration” according to this invention is defined as the time required for the fibre to interact with water and swell resulting an increase in viscosity.

In a preferred embodiment fibre is a water insoluble dietary fibre, preferably a water insoluble vegetable and/or fruit dietary fibre.

It is preferably selected from at least one of pea, lentil, fava bean, lupin, chick pea, black bean, potato, carrot, sugar beet, beetroot, pumpkin, kale, psyllium, oat bran, maize bran, rice bran, barley bran, citurs, apple, wheat bran, cocoa, blackcurrant, spent grain, fibres from microorganisms and combinations of these.

In a preferred embodiment, the at least one fibre comprises a fibre selected from pea, cocoa, blackcurrant, spent grain, wheat bran or combinations thereof, most preferably cocoa and thereof.

In a preferred embodiment, the cocoa fibre is derived from cocoa husk or cocoa bean shells, optionally roasted. The cocoa fibre may be prepared by known methods and the source is not particularly limited.

Fibre preferably has particle size with median diameter Dv_{50} in the range of 5 to 400 μm , preferably in the range of 10 to 400 μm , preferably in the range of 15 to 400 μm , preferably in the range of 20 to 400 μm , preferably 25 to 375 μm , preferably 30 to 350 μm ; preferably 35 to 300 μm .

In a further embodiment, the lipid-fibre powder comprises fibre in an amount in the range of 22 to 60% (by weight of the lipid-fibre powder), preferably between 22 to 55%, preferably between

22 to 50%, preferably 22 to 45%, preferably 22 to 40% (by weight of the lipid-fibre powder). For example, between 40 to 70% by weight of the powder is oil or fat.

In an embodiment water is added at a weight ratio of fibre to water between 1:2.5 and 1:35, preferably between 1:3 and 1:30, preferably between 1:3.5 and 1:30, preferably between 1:3.5 and 1:25, preferably between 1:3.5 and 1:20.

“Dietary fibre” consists of the remnants of the edible plant cell, polysaccharides, lignin, and associated substances resistant to digestion (hydrolysis) by human alimentary enzymes.

In a preferred embodiment, the lipid-fibre powder of the present invention does not include any emulsifier, added proteins or combinations thereof. The term “emulsifier” is selected from the group consisting of egg yolk, lecithin, mustard, soy lecithin, sodium phosphates, sodium stearoyl lactylate, diacetyl tartaric ester of monoglyceride (DATEM), polyglycerol-polyricinoleate (PGPR), monoglyceride and mono-diglyceride or a combination thereof. The term “protein” is selected from the group consisting of milk and/or whey proteins, soy proteins, pea proteins, caseinate, egg albumen, lysozyme, gluten, rice protein, corn protein, potato protein, pea protein, skimmed milk proteins or any kind of globular and random coil proteins as well as combinations thereof.

The drying step can be carried out by any commonly known drying technique such as air drying, oven drying, ventilation, spray drying, vacuum drying, bed drying, microwave-vacuum drying, infrared radiation drying or combinations thereof. The drying temperature is between 50 to 120°C, preferably between 50 to 110°C, preferably between 60 to 100°C, preferably between 60 to 90°C.

Milling according to this invention is a process that breaks solid materials into smaller pieces by grinding, crushing, or cutting. Milling can be carried out by any commonly known milling techniques such as roll mill, hammer mill, chopper mill, ball mill, SAG mill, rod mill or combinations thereof.

As it is shown within the experimental part independently of the mixing sequence of the fibre, oil or fat, and water a powdered lipid-fibre can be obtained after drying. In case fibre and water is mixed first the viscosity of this mixture is higher due to the swelling of the fibre. Therefore adding oil or fat to the fibre-water-suspension needs a longer mixing time or a higher mixing shear rate to obtain a homogenous fibre-lipid-water mixture. In a preferred embodiment the fibre and oil or fat is mixed first and water is added afterwards and further mixed. This process sequence has the advantage that the resulting lipid-fibre-water-suspension ensures a better homogenous mixture in less time or lower mixing shear rate.

“Flow-ability” means flow properties on how easily a powder flows. Flow-ability (ff_c) is quantified as the ratio of consolidation stress σ_1 to unconfined yield strength σ_c according to “Schulze, D. (2006). Flow properties of powders and bulk solids. Braunschweig/Wolfenbüttel, Germany: University of Applied Sciences.” In an embodiment flow-ability (ff_c) of the lipid-fibre powder is at least 1.8 at 23°C, preferably between the range of 1.8 to 12 at 23°C, preferably between the range of 1.9 to 10 at 23°C, preferably between the range of 1.9 to 8 at 23°C, preferably between the range of 1.9 to 6 at 23°C.

Such fat-based confectionery product can preferably be a chocolate products (as defined herein), more usefully be chocolate or a chocolate compound. Independent of any other legal definitions that may be used compositions of the invention that comprises a cocoa solids content of from 25% to 35% by weight together with a milk ingredient (such as milk powder) may be informally referred to herein as ‘milk chocolate’ (which term also encompasses other analogous chocolate products, with similar amounts of cocoa-solids or replacements therefor). Independent of any other legal definitions that may be used compositions of the invention that

comprises a cocoa solids content of more than 35% by weight (up to 100% (i.e. pure cocoa solids) may be informally referred to herein as 'dark chocolate' (which term also encompasses other analogous chocolate products, with similar amounts of cocoa-solids or replacements therefor).

The term 'chocolate' as used herein denotes any product (and/or component thereof if it would be a product) that meets a legal definition of chocolate in any jurisdiction and also include product (and/or component thereof) in which all or part of the cocoa butter (CB) is replaced by cocoa butter equivalents (CBE) and/or cocoa butter replacers (CBR).

The term 'chocolate compound' as used herein (unless the context clearly indicates otherwise) denote chocolate-like analogues characterized by presence of cocoa solids (which include cocoa liquor/mass, cocoa butter and cocoa powder) in any amount, notwithstanding that in some jurisdictions compound may be legally defined by the presence of a minimum amount of cocoa solids.

The term 'chocolate product' as used herein denote chocolate, compound and other related materials that comprise cocoa butter (CB), cocoa butter equivalents (CBE), cocoa butter replacers (CBR) and/or cocoa butter substitutes (CBS). Thus, chocolate product includes products that are based on chocolate and/or chocolate analogues, and thus for example may be based on dark, milk or white chocolate.

Unless the context clearly indicates, otherwise it will also be appreciated that in the present invention, any one chocolate product may be used to replace any other chocolate product and neither the term chocolate nor compound should be considered as limiting the scope of the invention to a specific type of chocolate product. Preferred chocolate product comprises chocolate and/or compound, more preferred chocolate product comprises chocolate, most preferred chocolate product comprises chocolate as legally defined in a major jurisdiction (such as Brazil, EU and/or US).

The term 'choco-coating' as used herein (also refers to a 'choco-shell') denotes coatings made from any chocolate product. The terms 'chocolate coating' and 'compound coating' may be defined similarly by analogy. Similarly the terms 'choco-composition, (or mass)', 'chocolate composition (or mass)' and 'compound composition (or mass)' denote compositions (or masses) that respectively comprise chocolate product, chocolate and compound as component(s) thereof in whole or part. Depending on their component parts the definitions of such compositions and/or masses may of course overlap.

The term 'chocolate product confectionery as used herein denotes any foodstuff which comprises chocolate product and optionally also other ingredients and thus may refer to foodstuffs such confections, wafers, cakes and/or biscuits whether the chocolate product comprises a choco- coating and/or the bulk of the product. Chocolate product confectionery may comprise chocolate product in any suitable form for example as inclusions, layers, nuggets, pieces and/or drops. The confectionery product may further contain any other suitable inclusions such as crispy inclusions for example cereals (e.g. expanded and/or toasted rice) and/or dried fruit pieces.

The chocolate product of the invention may be used to mould a tablet and/or bar, to coat confectionery items and/or to prepare more complex confectionery products. Optionally, prior to its use in the preparation of a chocolate product confectionery product, inclusions according to the desired recipe may be added to the chocolate product. As it will be apparent to a person skilled in the art, in some instances the product of the invention will have the same recipe and ingredients as the corresponding composition and/or mass while in other instances, particularly

where inclusions are added or for more complex products, the final recipe of the product may differ from that of the composition and/or mass used to prepare it.

In one strongly preferred embodiment of the invention, the chocolate product confectionery product comprises a substantially solid moulded choco-tablet, choco-bar and/or baked product surrounded by substantial amounts of chocolate product. These products are prepared for example by substantially filling a mould with chocolate product and optionally adding inclusions and/or baked product therein to displace chocolate product from the mould (so-called wet shelling processes), if necessary further topping up the mould with chocolate product. For such strongly preferred products of the invention the chocolate product forms a substantial or whole part of the product and/or a thick outside layer surrounding the interior baked product (such as a wafer and/or biscuit laminate). Such solid products where a mould is substantially filled with chocolate are to be contrasted with products that comprise moulded thin chocolate shells which present different challenges. To prepare a thin-coated chocolate shell a mould is coated with a thin layer of chocolate, the mould being inverted to remove excess chocolate and/or stamped with a cold plunger to define the shell shape and largely empty the mould. The mould is thus coated with a thin layer of chocolate to which further ingredients and fillings may be added to form the interior body of the product.

Unless the context herein clearly indicates, otherwise it will also be well understood by a skilled person that the term chocolate product confectionery as used herein can readily be replaced by and is equivalent to the term chocolate confectionery as used throughout this application and in practice these two terms when used informally herein are interchangeable. However, where there is a difference in the meaning of these terms in the context given herein, then chocolate confectionery and/or compound confectionery are preferred embodiments of the chocolate product confectionery of the present invention, a preferred embodiment being chocolate confectionery.

Preferred chocolate product confectionery may comprise one or more -ingredients, for example selected from the group consisting of: chocolate product(s), compound product(s), chocolate coating(s) and/or compound coating(s). The products may comprise uncoated products such as choco-bar(s) and/or choco-tablet(s) with or without inclusions and/or products coated with chocolate product such as coated biscuits, cakes, wafers and/or other confectionery items. More preferably and/or alternatively any of the aforementioned may comprise one or more cocoa butter replacer(s) (CBR), cocoa-butter equivalent(s) (CBE), cocoa-butter substitute(s) (CBS) and/or any suitable mixture(s) thereof.

In chocolate product confectionery, the cocoa butter (CB) may be replaced by fats from other sources. Such products may generally comprise one or more fat(s) selected from the group consisting of: lauric fat(s) (e.g. cocoa butter substitute (CBS) obtained from the kernel of the fruit of palm trees); non-lauric vegetable fat(s) (e.g. those based on palm or other specialty fats); cocoa butter replacer(s) (CBR); cocoa butter equivalent(s) (CBE) and/or any suitable mixture(s) thereof. Some CBE, CBR and especially CBS may contain primarily saturated fats and very low levels of unsaturated omega three and omega six fatty acids (with health benefits). Thus in one embodiment in chocolate product confectionery of the invention such types of fat are less preferred than CB.

One embodiment of the invention provides a multi-layer product optionally comprising a plurality of layers of baked foodstuff (preferably selected from one or more wafer and/or biscuit layers, and/or one or more fillings layers there between with at least one coating layer located around these layers foodstuff, the coating comprising a chocolate product of or prepared according to the invention.

A further embodiment of the invention provides a chocolate product confectionery product, further coated with chocolate (or equivalents thereof, such as compound) for example a praline, chocolate shell product and/or chocolate coated wafer or biscuit any of which may or may not be layered. The chocolate coating can be applied or created by any suitable means, such as enrobing or moulding. The coating may comprise a chocolate product of or prepared according to the invention.

Another embodiment of the invention provides a chocolate product confectionery product of and/or used in the present invention, that comprises a filling surrounded by an outer layer for example a praline, chocolate shell product.

In another preferred embodiment of the invention the foodstuff comprises a multi-layer coated chocolate product comprising a plurality of layers of wafer, chocolate product, biscuit and/or baked foodstuff, with filling sandwiched between them, with at least one layer or coating being a chocolate product (e.g. chocolate) of the invention. Most preferably the multi-layer product comprises a chocolate product confectionery product (e.g. as described herein) selected from sandwich biscuit(s), cookie(s), wafer(s), muffin(s), extruded snack(s) and/or praline(s). An example of such a product is a multilayer laminate of baked wafer and/or biscuit layers sandwiched with filling(s) and coated with chocolate.

Baked foodstuffs used in the invention may be sweet or savoury. Preferred baked foodstuffs may comprise baked grain foodstuffs which term includes foodstuffs that comprise cereals and/or pulses. Baked cereal foodstuffs are more preferred, most preferably baked wheat foodstuffs such as wafer(s) and/or biscuit(s). Wafers may be flat or shaped (for example into a cone or basket for ice-cream) and biscuits may have many different shapes, though preferred wafer(s) and/or biscuit(s) are flat so they can be usefully be laminated together with a confectionery filling of the invention (and optionally a fruit based filling). More preferred wafers are non-savoury wafers, for example having a sweet or plain flavour.

A non-limiting list of those possible baked foodstuffs that may comprise chocolate compositions that comprise chocolate product of and/or used in the present invention are selected from: high fat biscuits, cakes, breads, pastries and/or pies; such as from the group consisting of: ANZAC biscuit, biscotti, flapjack, kurabiye, lebkuchen, leckerli, macroon, bourbon biscuit, butter cookie, digestive biscuit, custard cream, extruded snacks, florentine, garibaldi gingerbread, koulourakia, kourabiedes, Linzer torte, muffin, oreo, Nice biscuit, peanut butter cookie, polvorón, pizzelle, pretzel, croissant, shortbread, cookie, fruit pie (e.g. apple pie, cherry pie), lemon drizzle cake, banana bread, carrot cake, pecan pie, apple strudel, baklava, berliner, bichon au citron and/or similar products.

Preferably, the fat based confectionery material, preferably chocolate compositions, of the present invention comprises at least 1.0% by weight, preferably at least 2.0% by weight, more preferably at least 4.0% by weight, and even more preferably at least 5.0% lipid-fibre powder by weight of the composition.

The preferred maximum amount of lipid-fibre powder present in the fat based confectionery material, preferably chocolate compositions, of the present invention is less than 40.0% by weight, preferably not more than 30.0% by weight, not more than 25.0% by weight, or not more than 20.0% by weight or not more than 15.0% by weight or lipid-fibre powder by weight of the confectionery. For example, between 1.0wt% and 40.0wt% of the confectionery material or between 2.0wt% and 15wt%.

Preferably, the fat based confectionery material, preferably chocolate compositions, of the present invention comprises at least 10.0% by weight, preferably at least 13.0% by weight,

more preferably at least 15.0% by weight, and even more preferably at least 17.0% cocoa butter by weight of the composition.

The preferred maximum amount of cocoa butter present in the fat based confectionery material, preferably chocolate compositions, of the present invention is less than 45.0% by weight, preferably not more than 35.0% by weight, not more than 30.0% by weight, or not more than 25.0% cocoa butter by weight. For example, between 10.0wt% and 45.0wt% of the confectionery material.

Preferably, the fat based confectionery material, preferably chocolate compositions, of the present invention comprises at least 10.0% by weight, preferably at least 13.0% by weight, more preferably at least 15.0% by weight, and even more preferably at least 17.0% cocoa mass by weight of the composition.

The preferred maximum amount of cocoa mass present in the fat based confectionery material, preferably chocolate compositions, of the present invention is less than 35.0% by weight, preferably not more than 30.0% by weight or not more than 25.0% cocoa mass by weight. For example, between 10.0 wt% and 35.0wt% of the confectionery material.

In an embodiment, the present invention provides a composition comprising between 1.0wt% and 40.0wt% lipid powder, between 10.0wt% and 45.0wt% cocoa butter and 10.0 wt% and 35.0wt% cocoa mass.

In an embodiment, the fat based confectionery material, preferably chocolate compositions, of the present invention preferably contain other ingredients used in chocolate production, for example other ingredients selected from the group consisting of a milk ingredient (e.g. milk non-fat milk solids, powder - optionally full cream, skimmed or semi-skimmed, milk fat), crystalline sugar, an emulsifier (e.g. lecithin, polyglycerol polyricinoleate and ammonium phosphatide) and combinations thereof. For example, the crystalline sugar may be present in an amount of 10.0-60.0wt% of the confectionery composition. For example, the milk powder may be present in an amount of 0.0-40.0wt% of the confectionery composition. For example, the milk fat may be present in an amount of 0.0-10.0wt% of the confectionery composition. For example, the emulsifier may be present in an amount of 0.0-1.0wt% of the confectionery composition.

Accordingly, the present invention provides a fat-based confectionery product comprising:

- between 1.0wt% and 40.0wt% lipid-fibre powder;
- between 10.0 wt% and 35.0wt% cocoa mass;
- between 10.0wt% and 45.0wt% cocoa butter;
- between 10.0wt% and 60.0wt% crystalline sugar;
- between 0.0wt% and 10.0wt% milk fat;
- between 0.0wt% and 40.0wt% milk powder; and
- between 0.0wt% and 1.0wt% emulsifier.

In an embodiment, the above percentages equate to 100wt% of the fat-based confectionery product.

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

Unless the context clearly indicates otherwise, as used herein plural forms of the terms herein are to be construed as including the singular form and vice versa.

In all ranges defined above, the end points are included within the scope of the range as written. Additionally, the end points of the broadest ranges in an embodiment and the end points of the narrower ranges may be combined.

It will be understood that the total sum of any quantities expressed herein as percentages cannot (allowing for rounding errors) exceed 100%. For example the sum of all components of which the composition of the invention (or part(s) thereof) comprises may, when expressed as a weight (or other) percentage of the composition (or the same part(s) thereof), total 100% allowing for rounding errors. However where a list of components is non exhaustive the sum of the percentage for each of such components may be less than 100% to allow a certain percentage for additional amount(s) of any additional component(s) that may not be explicitly described herein.

The term "substantially" as used herein may refer to a quantity or entity to imply a large amount or proportion thereof. Where it is relevant in the context in which it is used "substantially" can be understood to mean quantitatively (in relation to whatever quantity or entity to which it refers in the context of the description) there comprises an proportion of at least 80%, preferably at least 85%, more preferably at least 90%, most preferably at least 95%, especially at least 98%, for example about 100% of the relevant whole. By analogy the term "substantially-free" may similarly denote that quantity or entity to which it refers comprises no more than 20%, preferably no more than 15%, more preferably no more than 10%, most preferably no more than 5%, especially no more than 2%, for example about 0% of the relevant whole. Preferably, where appropriate (for example in amounts of ingredient) such percentages are by weight.

Unless otherwise specified, the percentages listed are by weight.

The present invention is further described by reference to the non-limiting specific examples.

EXAMPLES

The invention is further described with reference to the following examples. It is to be appreciated that the examples do not in any way limit the invention.

Example 1: Process

The general procedure for preparing oil powder of the invention is as follows:

- Mixing fibre and oil
- Add water and further mix
- Drying
- Milling (optional)

Fibre was mixed with oil in a Thermomix TM5 (Vorwerk &Co. KG). Mixing speed was set to speed 3. Mixing was performed at room temperature for 5 minute, until homogenous slurry was obtained. Subsequently, water was gradually added to the mixture while mixing parameters were maintained. Mixing was maintained for another 3 minute. The slurry was then spread onto a baking pan; slurry thickness was maintained between 5 and 10 mm, then dried in Rational Self Cooking Centre Electric Combination Oven SCC202E (Rational AG, Germany). Drying was carried out for 12 h at 70 °C with 30% fan speed.

In order to evaluate and understand rate of hydration of fibre, experiments were performed in the laboratory under controlled conditions using a Rapid Viscosity Analyser (Newport Scientific, Australia). The method has been slightly modified as described within the reference "Instant Emulsions, Tim Foster *et al*, pages 413-422 in Dickinson, E. and M. E. Leser (2007).

Food Colloids: Self-assembly and Material Science, Royal Society of Chemistry.” Rate of hydration of fibres were measured by following the change in viscosity with time. 2.5g of fibre or non-fibre material was weighed and added to 22.5g of water. Measurement was carried out at 25°C under continuously steering at 160 rpm. The value for rate of hydration is determined by subtracting the final viscosity value from the initial viscosity value and then divided by the time, i.e. 10 min. When maximum (peak) viscosity value is observed earlier than 10 min (e.g. for the case of citrus fibre), the rate of hydration is determined by subtracting the maximum viscosity from the initial viscosity values and then divided by the time to reach this maximum viscosity value.

Example 2-8: Comp. process without added water and process with added water

In case oil is mixed only with fibre alone (no water added), no oil powder can be obtained independently if the rather slurry mixture has been dried and independently of the used oil-fibre ratio (comp. examples 2 to comp. examples 5)

Examples 6-8 have been prepared according to the process of example 1 (water added) resulting in an oil powder.

	Comp Ex. 2	Comp. Ex. 3	Comp. Ex. 4	Comp. Ex. 5
Oil (sunflower) [wt%]	78	78	50	67
Fibre type	Carrot fibre	Carrot fibre	Carrot fibre	Carrot fibre
Fibre [wt%]	22	22	50	33
Water [in weight ratio of fibre to water]	1:0 (no water added)	1:0 (no water added)	1:0 (no water added)	1:0 (no water added)
Drying temp. [° C]	Not dried.	70	70	70
Flow-ability index	n.a. as no oil powder	n.a. as no oil powder	n.a. as no oil powder	n.a. as no oil powder

	Ex. 6	Ex. 7	Ex. 8
Oil (sunflower) [wt%]	78	50	67
Fibre type	Carrot fibre	Carrot fibre	Carrot fibre
Rate of hydration of fibre (cP/min)	106	106	106
Fibre [wt%]	22	50	33
Water [in weight ratio of fibre to water]	1:9	1:9	1:9
Drying temp. [° C]	70	70	70
Flow-ability index	2.1	6.2	3.5
Comments	Oil powder	Oil powder	Oil powder
Induction period	58h	-	-

The induction period of example 6 is defined as the period (measured in hours) during which no oxidative, volatile components are generated under certain defined conditions. The induction period is determined based on ISO method 6886:2006; Rancimat/Oxidative Stability Instrument; at 100.0 ± 0.1 °C; 3.85 ± 0.1 g powdered oil, airflow: 10.0 l/h. Example 6 has an induction period of 58 hours, wherein the corresponding standard sunflower oil has an induction period of 38 hours.

Examples 9-16: Different origin of fibre

Different kind of fibres have been tested according the process of example 1. Examples 9 to 16 show that the rate of hydration of fibre should be between 15 to 500 cP/min to obtain an oil powder.

	Ex. 9	Ex. 10	Comp. Ex. 11	Comp. Ex. 12
Oil (sunflower) [wt%]	78	78	78	78
Fibre origin	Beet root	Pumpkin	Citrus	Apple
Rate of hydration of fibre (cP/min)	104	253	5300	2
Fibre [wt%]	22	22	22	22
Water [in weight ratio of fibre to water]	1:9	1:9	1:9	1:9
Drying temp. [°C]	70	70	70	70
Flow-ability index	2.0	2.0	n.a. as no powder	n.a. as no powder
Comments	Oil powder	Oil powder	Oil separation	Oil separation

	Comp. Ex. 13	Comp. Ex. 14	Com. Ex. 15	Com. Ex. 16
Oil (sunflower) [wt%]	78	78	78	78
Fibre origin	Oat	Pea	Wheat bran	Wheat fibre
Rate of hydration of fibre (cP/min)	8	0.3	0.1	0.1
Fibre [wt%]	22	22	22	22
Water [in weight ratio of fibre to water]	1:9	1:9	1:9	1:9
Drying temp. [°C]	70	70	70	70

Flow-ability index	n.a. as no powder	n.a. as no powder	n.a. as no powder	n.a. as no powder
Comments	Oil separation	Oil separation	Oil separation	Oil separation

Comparative example 17-19: Other non-fibre ingredients

When starch, inulin or hydrolyzed whey protein is used instead of fibre, no oil powder according to the process within example 1 can be obtained as the rate of hydration is not between 15 to 500 cP/min.

	Comp. Ex. 17	Comp. Ex. 18	Comp. Ex. 19
Oil (sunflower) [wt%]	78	78	78
Non fibre ingredient	Native potato starch	Inulin	Hydrolyzed whey protein
Rate of hydration of fibre (cP/min)	0.1	0.1	0.3
Non fibre ingredient [wt%]	22	22	22
Water [in weight ratio of non-fibre ingredient to water]	1:9	1:9	1:9
Drying temp. [° C]	70	70	70
Flow-ability index	n.a. as no powder	n.a. as no powder	n.a. as no powder
Comments	Oil separation	Oil separation	Oil separation

Examples 20-24: Different amount of water

Different amount of water added to oil and carrot fibre have been tested according the process of example 1.

	Comp. Ex. 20	Comp. Ex. 21	Ex. 22	Ex. 23	Ex. 24
Oil (sunflower oil) [wt%]	78	78	78	78	78
Carrot Fibre [gram]	22	22	22	22	22
Water [in weight ratio of fibre to water]	2:1	1:2	1:4	1:12	1:25
Drying temp. [° C]	70	70	70	70	70
Flow-ability index	n.a. as no powder	n.a. as no powder	2.0	2.1	2.1

Comments	Slurry. Oil separation	Before drying: sandy texture; after drying: oil separation	Oil powder	Oil powder	Oil powder
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Example 25-26: Different origin of oil

Different oils resulted in an oil powder according to example 1.

	Ex. 25	Ex. 26
Oil origin	Olive	Avocado
Oil amount [gram]	78	50
Carrot fibre [gram]	22	50
Water [in weight ratio of fibre to water]	1:9	1.9
Drying temp. [° C]	70	100
Flow-ability index	2,1	Not Assessed
Comments	Oil powder	Oil powder

Example 27-29: Different particle size of fibres

Four different carrot fibres regarding the particle size have been tested according to example 1.

	Ex. 6 (repetition of example)	Ex. 27	Ex. 28	Ex. 29
Oil (sunflower oil) [gram]	78	78	78	78
Carrot Fibre [gram]	22	22	22	22
Carrot fibre Dv50 [µm]	30	75	170	250
Water [in weight ratio of fibre to water]	1:9	1:9	1:9	1:9
Drying temp. [° C]	70	70	70	70
Flow-ability index	2.1	2.0	2.1	2.0
Comments	Oil powder	Oil powder	Oil powder	Oil powder

It can be concluded that the tested particle size does not have an influence on the preparation of an oil powder.

Examples 30-38: Different fibre/oil ratios

Different fibre/oil ratios have been tested according to example 1.

	Ex. 30	Ex. 31	Ex. 32	Comp. Ex. 33
Oil (sunflower oil) [wt%]	50	67	75	80
Carrot Fibre [wt%]	50	33	25	20
Water [in weight ratio of fibre to water]	1:9	1:9	1:9	1:9
Drying temp. [° C]	70	70	70	70
Flow-ability	6.2	3.5	2.5	1.7
Comments	Oil powder	Oil powder	Oil powder	Oil lumps, wet texture

	Ex. 34	Ex. 35	Ex. 36	Ex. 37	Comp. Ex. 38
Oil (chicken fat) [wt%]	50	60	67	75	80
Carrot Fibre [wt%]	50	40	33	25	20
Water [in weight ratio of fibre to water]	1:9	1:9	1:9	1:9	1:9
Drying temp. [° C]	70	70	70	70	70
Flow-ability	5.9	4.4	3.3	2.4	1.7
Comments	Oil powder	Oil powder	Oil powder	Oil powder	Oil lumps, wet texture

Example 39-41: Alternative process

The sequence of mixing has been changed as follow compared to example 1:

- Mixing fibre with water
- Add oil and further mix
- Drying
- Milling (optional)

	Ex. 39	Ex. 40	Ex. 41
Oil (sunflower) [wt%]	50	67	78
Fibre type	Carrot fibre	Carrot fibre	Carrot fibre
Fibre [wt%]	50	33	22

Water [in weight ratio of fibre to water]	1:9	1:9	1:9
Drying temp. [° C]	70	70	70
Comments	Oil powder	Oil powder	Oil powder

It is shown within examples 39-41 that also with a different sequence of mixing the fibre, oil and water a powdered lipid-fibre can be obtained.

Example 42 and Comparison with Commercial Products

A chocolate recipe was tested: with 55% cocoa by mass including the powdered oil of the invention.

The powdered oil was prepared with 2 oils: hemp oil and avocado oil and using 2 types of fibre: cocoa fibre and carrot fibre

The powder was prepared as above with a 1 to 1 ratio with the fibre for both avocado and hemp oils and carrot fibre. Cocoa fibre was only tested with avocado oil. Chocolate samples with a high oleic sunflower oil and carrot fibre at 3:1 ratio were also tested.

Production of powder:

1. Addition of water to fibre until a thick paste is prepared
2. Addition of oil to water/fibre system
3. Spray the paste on a metal plate to go in the oven
4. Dry in the oven for ~2 to 4 hours, max. temperature 100°C
5. Thermomix the flakes to make a powder (1-2 min of mixing)
6. Add the powder in the chocolate recipe, before the refining

Ingredient name	UoM	Quantity
Sugar White 0.45 - 0.65 mm	kg	0.728
Cocoa Butter	kg	0.042
Cocoa Mass	kg	0.520
Hemp Oil Powder Carrot Fibres (1/1)	kg	0.210
Ingredient name	UoM	Quantity
Refining	kg	0.878
Cocoa Butter	kg	0.341

Ingredient name	UoM	Quantity
Sugar White 0.45 - 0.65 mm	kg	0.728
Cocoa Butter	kg	0.042
Cocoa Mass	kg	0.520

Avocado Oil Powder Cocoa Fibres (1/1)	kg	0.210
Ingredient name	UoM	Quantity
Refining	kg	0.878
Cocoa Butter	kg	0.341

Ingredient name	UoM	Quantity
Sugar White 0.45 - 0.65 mm	kg	0.728
Carrot fibres		0.070
Cocoa Butter	kg	0.042
Cocoa Mass	kg	0.520
Sunflower Oil Powder Carrot Fibres (3/1)	kg	0.140
Ingredient name	UoM	Quantity
Refining	kg	0.878
Cocoa Butter	kg	0.341

Ingredient name	UoM	Quantity
Sugar White 0.45 - 0.65 mm	kg	0.728
Cocoa Butter PPP Fully Deo Liq 24T Bulk	kg	0.042
Cocoa Mass	kg	0.520
Avocado Oil Powder Carrot Fibres (1/1)	kg	0.210
Ingredient name	UoM	Quantity
Refining	kg	0.878
Cocoa Butter	kg	0.341

The use of the fat powder was found to control bloom, even with the use of healthier oils. The texture of the products was found to not be dry or grainy and comparable to traditional chocolates.

In contrast, an avocado oil-containing chocolate from the UK and an hazelnut-oil containing filled chocolate from France were purchased and assessed. Both commercially available

chocolates displayed substantial bloom despite both being “fresh” (i.e. 2-3 months old maximum). Additionally, the avocado oil-containing chocolate was found to have a very dry and crumbly texture. Accordingly, the present invention affords the incorporation of healthier oils without impacting the texture and bloom properties.

Claims:

1. A process for the production of a fat-based confectionery comprising a lipid-fibre powder comprising between 30 to 80wt% of an oil or fat and 20 to 70wt% of a fibre, the process comprising the steps of:
 - a) Mixing fibre, oil or fat, and water at a weight ratio of fibre to water between 1:2.5 and 1:30;
 - b) Drying the mixture of step a);
 - c) Optionally milling the lipid-fibre powder after the drying step b); and
 - d) Combining the powder with other ingredients of the fat-based confectionery,wherein the fibre is characterized by having a rate of hydration between 15 to 500 cP/min and preferably wherein the oil or fat has a solid fat content (SFC) at 20°C below 12 wt%.
2. A process for the production of a fat-based confectionery as claimed in claim 1, wherein the fibre is a water insoluble dietary fibre.
3. A process for the production of a fat-based confectionery as claimed in any one of claims 1 to 2, wherein the fibre comprises at least cocoa fibre.
4. A process for the production of a fat-based confectionery as claimed in any one of claims 1 to 3, wherein the oil or fat is selected from the group consisting of sunflower oil, rapeseed oil, linseed oil, flaxseed oil, cotton seed oil, primrose oil, peanut oil, soy oil, olive oil, insect fat, algal oil, safflower oil, corn oil, rice bran oil, sesame oil, hazelnut oil, avocado oil, almond oil, walnut oil, hemp oil, macadamia, other nut oils, cardamom oil, coffee oils, pumpkin seed oil, argan oil, grapeseed oil or a combination thereof.
5. A process for the production of a fat-based confectionery as claimed in any one of claims 1 to 4, wherein the process further comprises mixing the lipid-fibre powder with fat and optionally ingredients selected from the group consisting of cocoa liquor, crystalline sugar, lecithin and combinations of these; optionally refining the resulting mixture to reduce the particle size of the components; and mixing the refined mixture with further fat and optionally lecithin and liquefying.
6. A process for the production of a fat-based confectionery as claimed in any one of claims 1 to 5, wherein the lipid-fibre powder has a flow-ability of at least 1.8 at 23°C.
7. A process for the preparation of a fat-based confectionery as claimed in any one of claims 1 to 6, wherein the drying is done at a temperature between 50 to 120°C.
8. A process for the preparation of a fat-based confectionery as claimed in any one of claims 1 to 7, wherein the drying is done by oven drying, air drying, vacuum drying, bed drying, microwave-vacuum drying, spray-drying, infrared radiation drying or combinations thereof.
9. A process for the preparation of a fat-based confectionery as claimed in any one of claims 1 to 8, wherein the fibre and oil or fat is mixed first and water is added afterwards and further mixed.
10. A process for the preparation of a fat-based confectionery as claimed in any one of claims 1 to 9 wherein the lipid-fibre powder does not contain any emulsifier or protein or combinations thereof.

11. A fat-based confectionery comprising a lipid-fibre powder obtainable by the process of one of the claims 1 to 10.
12. The fat-based confectionery as claimed in claim 11, wherein the the confectionery material is chocolate, preferably a dark chocolate, a milk chocolate or a white chocolate.
13. The fat-based confectionery as claimed in claim 11 or claim 12, wherein the the confectionery material comprises between 1.0wt% and 40.0wt% of the lipid-fibre powder by weight of the confectionery material.
14. The fat-based confectionery as claimed in claim 13 wherein the the confectionery material comprises between 2.0wt% and 15wt% of the lipid-fibre powder by weight of the confectionery material.

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2020/061897

A. CLASSIFICATION OF SUBJECT MATTER INV. A23G1/36 A23G1/48 A23L33/21 ADD.		
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) A23G A23L		
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, WPI Data		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 4 948 600 A (ZUMBE ALBERT [CH] ET AL) 14 August 1990 (1990-08-14) claims; examples -----	11-14
X	DE 27 46 479 A1 (BAYER AG) 19 April 1979 (1979-04-19) page 1 - page 4; claims; examples -----	11-14
X	WO 2012/089691 A1 (NESTEC SA [CH]; DOPFER DANIEL JOHANNES [CH] ET AL.) 5 July 2012 (2012-07-05) -----	11-14
Y	claims; examples -----	1-10
Y	US 2006/246179 A1 (AMMANN CHRISTINA [CH] ET AL) 2 November 2006 (2006-11-02) claims; examples -----	1-10
<input style="width: 20px; height: 20px; margin-right: 5px;" type="checkbox"/> Further documents are listed in the continuation of Box C. <input checked="" style="width: 20px; height: 20px; margin-right: 5px;" type="checkbox"/> 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 "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art "&" document member of the same patent family		
Date of the actual completion of the international search 24 June 2020	Date of mailing of the international search report 02/07/2020	
Name and mailing address of the ISA/ European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Authorized officer Bondar, Daniela	

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