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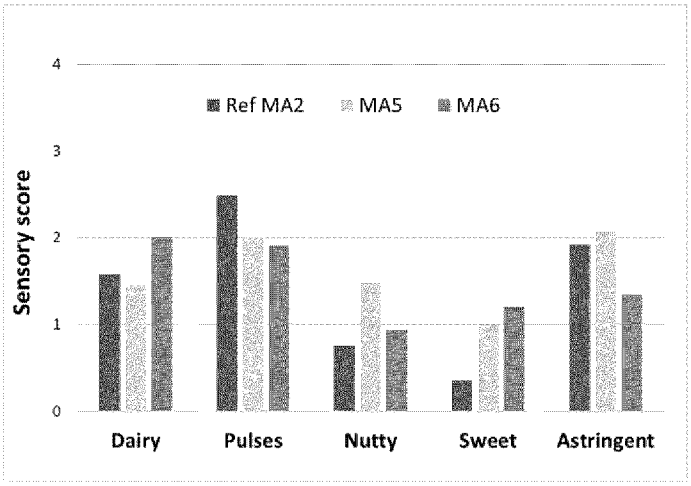


FIGURE 5

(57) Abstract: Dairy product analogues with improved sensory properties are disclosed. The dairy product analogues comprise plant proteins and vinegar. Processes for preparing such dairy product analogues are also disclosed.

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DAIRY PRODUCT ANALOGUES COMPRISING VINEGAR

TECHNICAL FIELD

The present invention relates generally to the field of dairy product analogues, in particular milk analogues. For example, the present invention relates to dairy product analogues which comprise vinegar and processes for preparing such dairy product analogues.

BACKGROUND OF THE INVENTION

Some consumers wish to reduce or even stop their consumption of milk and dairy products derived from milk. For example, this can be for reasons of lactose intolerance, dairy allergies, or environmental sustainability.

To meet this growing consumers' demand, food companies propose dairy products analogues, including milk analogues, on the market worldwide. These dairy products analogues are prepared with plant ingredients including plant protein ingredients. They may comprise limited amount of milk ingredients or they may even be free from milk ingredients compared to standard dairy products.

Dairy product analogues, in particular milk analogues exhibit sensory defects, such as off-notes, compared to corresponding standard dairy products due to the use of plant ingredients and the limited or absence of milk ingredients in their preparation. In view of these sensory defects, the sensory properties of dairy product analogues, in particular milk analogues are not fully satisfactory and there is room for improvement. In particular, they are generally characterized by unpleasant green, pulses, cereal aromatic notes while they are generally lacking dairy or fruity.

It would therefore be desirable to provide a dairy product analogue, in particular milk analogue, with improved sensory properties.

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 a dairy product analogue and processes that overcome 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, a first aspect of the invention proposes a dairy product analogue which comprises plant proteins and vinegar.

A second aspect of the invention proposes a process for preparing a dairy product analogue with vinegar comprising the steps of:

a) preparing a dairy product analogue which is devoid of vinegar,

b) adding vinegar in the dairy product analogue devoid of vinegar to obtain a dairy product analogue.

1. A third aspect of the invention proposes a process for preparing a dairy product analogue comprising the steps of :

a) dispersing a plant protein ingredient with an aqueous liquid to form a plant protein dispersion,

b) optionally, mixing the plant protein dispersion of step a) with additional ingredients,

c) homogenizing the plant protein dispersion,

d) heat treating the plant protein dispersion to obtain a dairy product analogue,

e) optionally, drying the dairy product analogue,

wherein a vinegar is added in the plant protein dispersion and/or the dairy product analogue, preferably the vinegar is added:

-in the plant protein dispersion between step a) and c), or

-in the dairy product analogue after step d), when step d) is after step c), or

-in the dairy product analogue after step c), when step c) is after step d).

It has been discovered that the use of vinegar in dairy product analogues, in particular milk analogues, improve their sensory properties.

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.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 shows the volatile aroma compound composition of different types of vinegar obtained by HS-SPME-GC-MS. The aroma compounds were categorized by chemical family. No quantitative analysis was performed.

Figure 2 shows the volatile aroma compound composition of different types of vinegar obtained by HS-SPME-GC-MS. The aroma compounds were categorized by chemical family. No quantitative analysis was performed. The data of figure 1 are expressed in percentage in figure 2. In particular, in figure 2, the data of figure 1 were expressed in percentage respective to the total height of different peaks of figure 1.

Figure 3 shows the volatile aroma compound composition of different milk analogues prepared without vinegar or with different types of vinegar obtained by HS-SPME-GC-MS. The aroma compounds were categorized by chemical family. No quantitative analysis was performed.

Figure 4 shows the volatile aroma compound composition of the different milk analogues prepared without vinegar or with different types of vinegar obtained by HS-SPME-GC-MS. The aroma compounds were categorized by chemical family. No quantitative analysis was performed. The data of figure 3 are expressed in percentage in figure 4. In particular, in figure 4, the data of figure 3 were expressed in percentage respective to the total height of different peaks of figure3.

Figure 5 shows the average sensory scores obtained for different sensory attributes for a reference milk analogue (=ref MA2) according to example 4 and for milk analogues (= MA5 and MA6) prepared with different vinegar as disclosed in example 4.

Figure 6 shows the average sensory scores obtained for different sensory attributes for a reference hybrid milk analogue (=ref HMA) according to example 5 and for a hybrid milk analogue (=HMA1) prepared with apple vinegar as disclosed in example 5.

DETAILED DESCRIPTION OF THE INVENTION

As used herein, 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. Likewise, the terms “include,” “including” and “or” should all be construed to be inclusive, unless such a construction is clearly prohibited from the context. Nevertheless, the compositions/products disclosed herein may lack any element that

is not specifically disclosed herein. Thus, a disclosure of an embodiment using the term "comprising" includes a disclosure of embodiments "consisting essentially of" and "consisting of" the components identified.

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 herein should be understood to include all integers, whole or fractions, within the range. Moreover, these numerical ranges should be construed as providing support for a claim directed to any number or subset of numbers in that range. For example, a disclosure of from 1 to 10 should be construed as supporting a range of from 1 to 8, from 3 to 7, from 1 to 9, from 3.6 to 4.6, from 3.5 to 9.9, and so forth.

As used in the specification, the singular forms "a", "an", and "the" include plural referents unless the context clearly dictates otherwise. Thus, for example, reference to "an added fat ingredient" or "the added fat ingredient" includes one added fat ingredient but also two or more added fat ingredients.

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.

As used herein, the term "and/or" used in the context of "X and/or Y" should be interpreted as "X," or "Y," or "X and Y.". Similarly, "at least one of X or Y" should be interpreted as "X," or "Y," or "both X and Y.". For example, "vegetable oil and/or vegetable oil fraction" means "vegetable oil," or "vegetable oil fraction," or "both vegetable oil and vegetable oil fraction".

As used herein, the terms "example", "such as" and "e.g." particularly when followed by a listing of terms, are merely exemplary and illustrative and should not be deemed to be exclusive or comprehensive. But, a disclosure of an embodiment using the term "example" and "such as" includes a disclosure of embodiments" where the terms are exclusive and/or comprehensive.

As used herein, the term "total compound X" of a composition refers to all compounds X of said composition. For example, total fat of a composition refers to all the fat of said composition.

As used herein, the term "whole plant material" or "whole grain material" refers to a plant material, preferably a grain material, which is intact and has not undergone any step of mechanical disruption and/or fractionation to remove fibers, carbohydrates and/or proteins. A whole plant material, in particular whole grain material comprises the germ and the endosperm, optionally the bran and the hull. Preferably, a whole plant material, in particular whole grain material comprises the germ, the endosperm, and the bran, and optionally the hull. More preferably, whole plant material, in particular whole grain material comprises the germ, the endosperm, the bran, and the hull. In particular, a whole plant material, in particular whole grain material is not plant protein flour, plant protein concentrate and plant protein isolate. For avoidance of doubt, the term "whole plant material" or whole grain material does not exclude a plant material, in particular a grain material which has undergone a step of removal of bran and/or hull.

As used herein, the term "plant protein flour" refers to a plant composition comprising a plant protein content from 5% to 49.9% proteins.

As used herein, the term "plant protein concentrate" refers to a plant composition comprising a plant protein content from 50% to 79.9%.

As used herein, the term "plant protein isolate" refers to a plant composition comprising a plant protein content from 80.0% to 99.0%.

As used herein, the term "aqueous liquid" refers to a liquid comprising at least 50%, preferably at least 70%, more preferably at least 80%, even more preferably at least 90%, most preferably consisting only of water.

As used herein, the term "dairy product analogue" refers to a food product which comprises ingredients of plant origin, including plant proteins, and which has qualities as to appearance, and texture as the corresponding real dairy product. Preferably, the dairy product analogue is free from milk ingredient. More preferably, the dairy product analogue is exclusively made from vegan ingredients.

As used herein, the term "vegan" refers to an edible composition which is entirely devoid of animal products, or animal derived products.

As used herein, the term "vegetarian" refers to an edible composition which is devoid of meat, including fish.

As used herein, the term "added texturizing agents" refers to agents that increase the viscosity of a food product. They may also be used to protect the proteins and prevent their aggregation after a heat treatment. It includes gums, starches, fiber, gelatin and the like. For

avoidance of doubt, this definition excludes the plant proteins, the plant protein ingredient, the added fat ingredient or the added carbohydrate ingredient. It also excludes the thickening agents that could be inherently present in the ingredients of the dairy product analogue.

As used herein, the term "added fat ingredient" refers to a food ingredient that comprises fat, in particular at least 80wt.% fat, preferably 80 to 100 wt.%, more preferably 95 to 100wt.% fat. This ingredient brings exogenous fat in the dairy product analogue. For avoidance of doubt, this term excludes the added carbohydrate ingredient, the protein ingredient or other ingredients of the dairy product analogue that may inherently comprise fat but that are not added with the purpose to increase or bring fat in the dairy product analogue.

As used herein, the term "added carbohydrate ingredient" refers to food ingredients that comprise at least 70wt% carbohydrates. This ingredient brings exogenous carbohydrates in the dairy product analogue. For avoidance of doubt, this term excludes the this term excludes the protein ingredient, the added fat ingredient or other ingredients of the dairy product analogue that may inherently comprise carbohydrates but that are not added with the purpose to increase or bring carbohydrates in the dairy product analogue.

As used herein, the term "coffee mix" refers to a food mix that comprises coffee and milk ingredients.

As used herein, the term "cocoa and/or malt beverage" refers to a beverage that comprises milk ingredients and cocoa and/or malt.

As used herein, the term "fruit vinegar" a vinegar originated from one or several fruits. For avoidance, the term "fruit vinegar" excludes vinegars which are made from alcoholic beverages, including alcoholic beverages originated from fruits such as wine or cider.

As used herein, the term "added flavors" refer to ingredients that are added to a food composition to impart a flavor. In the context of the invention, the plant proteins and vinegar as disclosed herein are excluded from this definition, even if they may impart a flavor.

In a first aspect, the invention relates to a dairy product analogue comprising plant proteins and vinegar.

In an embodiment, the vinegar is an aromatically complex vinegar. By "aromatically complex vinegar", it is referred to a vinegar that comprises at least one aromatic compound different than acetic acid. In particular, the vinegar is not a vinegar that consists only of acetic acid or consists only of acetic acid and water. For example, the vinegar is not a distilled vinegar

that consists only of acetic acid and water. It has been observed that the sensory properties of dairy product analogue are not significantly improved in presence of acetic acid alone.

In an embodiment, the vinegar is selected from the group consisting of rice vinegar, balsamic vinegar, white wine vinegar, red wine vinegar, apple cider vinegar, malt vinegar, champagne vinegar, sherry vinegar, black vinegar, cane vinegar, beer vinegar, raspberry vinegar, honey vinegar, fruit vinegar, and mixture thereof. In a preferred embodiment, the vinegar is selected from the group consisting of rice vinegar, balsamic vinegar, fruit vinegar, apple cider vinegar, and mixture thereof. In a more preferred embodiment, the vinegar is selected from the group consisting of rice vinegar, balsamic vinegar, apple vinegar, apple cider vinegar, and mixture thereof.

In an embodiment, the balsamic vinegar may be white balsamic vinegar, black balsamic vinegar, or a mixture thereof. In an embodiment, the fruit vinegar may be selected from the group consisting of raspberry vinegar, apple vinegar, pear vinegar, mango vinegar, papaya vinegar, plum vinegar, citrus vinegar, peach vinegar, grape vinegar and mixture thereof.

In a preferred embodiment, the vinegar is apple vinegar. In another preferred embodiment, the vinegar is dark balsamic vinegar. In another preferred embodiment, the vinegar is white balsamic vinegar. In another preferred embodiment, the vinegar is rice vinegar.

In an embodiment, the vinegar is liquid or powdered. In some preferred embodiment, the vinegar is liquid. Liquid vinegar may be advantageous compared to powdered vinegar. Powdered vinegar may contain additional ingredients, in particular carrier matrix, that may be undesirable as they can, for example, impact nutritional and/or sensory properties (e.g. the carrier matrix comprising carbohydrates). Additionally, handling liquid vinegar may be more convenient compared to powders (e.g. no reconstitution needed). It has been discovered that the use of vinegar in dairy product analogues, in particular milk analogues, improve their sensory properties. In particular, the taste of dairy product analogues is improved in presence of vinegar. Moreover, acidic ingredients/agents are generally known to induce plant proteins destabilization/flocculation and so tend to adversely affect the sensory properties, in particular the texture of dairy product analogues, in particular milk analogues. Without wishing to be bound by theory, it is believed that the texture of dairy product analogues may also be improved in presence of vinegar even though vinegar is acid.

In some embodiment, the dairy product analogue comprises at least 0.05wt%, preferably 0.05wt% to 3wt%, more preferably 0.1 to 1wt%, more preferably 0.1 to 0.5wt% vinegar.

The vinegar is used at a concentration that does not trigger curdling of the dairy product analogue. The above concentrations of vinegar avoid curdling while imparting sensory improvement.

Indeed, the vinegar is mainly added to improve the sensory properties of the dairy product analogue and it is not added as curdling agent. Curdling is undesirable for the present invention as it generally leads, *inter alia*, to unwanted heterogenous and grainy texture. This is in particular undesirable for beverages.

In an embodiment, the plant proteins comprise, preferably consist of plant proteins selected from the group consisting of nut proteins (e.g. almond proteins, peanut proteins, etc.), seed proteins (e.g. hempseed proteins, sunflower seed proteins, pumpkin seed proteins etc.), cereal proteins, pulse proteins, fruit proteins (e.g. plantain banana proteins, coconut proteins etc.), tuber proteins (e.g. potato proteins, etc.) and combination thereof.

In another embodiment, the plant proteins comprise, preferably consist of plant proteins selected from the group consisting of nut proteins (e.g. almond proteins, peanut proteins, etc.), seed proteins (e.g. hempseed proteins, sunflower seed proteins, pumpkin seed proteins etc.), cereal proteins, pulse proteins, and combination thereof.

In a further embodiment, the plant proteins comprise, preferably consist of plant proteins selected from the group consisting of cereal proteins, pulse proteins, and combination thereof.

For example, the cereal proteins disclosed herein may be selected from the group consisting of oat proteins, wheat proteins, barley proteins, rice proteins, millet proteins, rye proteins, buckwheat proteins, amaranth proteins, quinoa proteins, corn proteins, sorghum proteins and combination thereof.

For example, the pulse proteins disclosed herein may be selected from the group consisting of pea proteins, faba proteins, soybean proteins, chickpea proteins, bean proteins, and combination thereof.

In an embodiment, the plant proteins of the dairy product analogue comprise, preferably consist of a combination of cereal proteins and pulse proteins. The cereal proteins may be cereal proteins as disclosed herein. The pulse proteins may be pulse proteins as

disclosed herein. For example, the plant proteins comprise, preferably consist of a combination of oat proteins and soybean proteins.

In some embodiment, the plant proteins of the dairy product analogue are originated from one or several plant protein ingredients. In particular, at least 50%, preferably 80%, more preferably 90%, even more preferably 95%, most preferably all the plant proteins of the dairy product analogue are originated from one or several plant protein ingredients. The plant protein ingredient is selected from the group consisting of ground whole plant material, plant protein flour, plant protein concentrate, plant protein isolate and mixture thereof. In some embodiment, the ground whole material is ground whole grain material. In some embodiment, the plant protein ingredient may be partially or fully defatted.

In an embodiment, the plant proteins of the dairy product analogue are coming from plant protein ingredient(s) which is/are coming from the same plant(s) as the plant proteins of the dairy product analogue. For example, if the dairy product analogue comprises only soybean proteins as plant proteins, the soybean proteins originate from a protein ingredient selected from the group consisting of ground whole soybean, soy flour, soy protein concentrate, soy protein isolate and mixture thereof.

The ground whole plant materials correspond to whole plant materials which are ground by mechanical/physical treatment. For example, the mechanical/physical treatment used to provide ground whole plant material may be performed by milling, grinding, blending or any other equivalent methods well known in the art. The mechanical/physical treatment may be wet, i.e. performed in presence of an aqueous liquid or dry, i.e. performed in absence of any aqueous liquid. Preferably, the aqueous liquid is water.

In some embodiment, the whole plant material may be selected from the group consisting of whole nut (e.g. whole almond, whole peanut, etc.), whole seed (e.g. whole hempseeds, whole sunflower seed, whole pumpkin seed etc.), whole cereal, whole pulse, whole fruit (e.g. whole plantain banana, whole coconut etc.), whole tuber (e.g. whole potato, etc.) and combination thereof.

In some embodiment, the whole plant material is whole grain material. In particular, the whole grain material is selected from the group consisting of whole nut (e.g. whole almond, whole peanut, etc.), whole seed (e.g. whole hempseeds, whole sunflower seed, etc.), whole cereal, whole pulse, and combination thereof. Preferably, the whole grain material is selected from the group consisting of whole cereal, whole pulse, and combination thereof.

For example, the whole cereal disclosed herein may be selected from the group consisting of whole oat, whole wheat, whole barley, whole rice, whole millet, whole rye, whole buckwheat, whole amaranth, whole quinoa, whole corn, whole sorghum and combination thereof.

For example, the whole pulse disclosed herein may be selected from the group consisting of whole pea, whole faba, whole soybean, whole chickpea, whole bean, and combination thereof.

In an embodiment, the whole grain material may be a combination of whole cereal and whole pulse. The whole cereal may be a whole cereal as disclosed herein and the whole pulse may be a whole pulse as disclosed herein. For example, the whole grain material is a combination of whole oat and whole soybean.

In a preferred embodiment, the plant protein ingredient is selected from the group consisting of plant protein flour, plant protein concentrate, plant protein isolate and mixture thereof.

In an embodiment, the dairy product analogue is devoid of milk proteins.

In an embodiment, at least 50%, preferably at least 70%, more preferably at least 80%, even more preferably at least 90% of all the proteins of the dairy product analogue consist of plant proteins, in particular consist of the plant proteins as disclosed herein. In a most preferred embodiment, all the proteins of dairy product analogue consist only of plant proteins, in particular consist only of the plant proteins as disclosed herein.

In an embodiment, the dairy product analogue comprises at least 0.5wt%, preferably 0.5 to 25wt%, more preferably 1 to 10wt%, more preferably 2 to 5wt% of proteins, preferably plant proteins.

In an embodiment, the dairy product analogue may further comprise an added fat ingredient. In an embodiment, the added fat ingredient may comprise milk fat. The added fat ingredient may be selected from the list consisting of milk fat (e.g. butter), vegetable butter, vegetable oil, vegetable oil fraction or a mixture thereof.

In an embodiment, the added fat ingredient may be devoid of milk fat. The added fat ingredient may be selected from the list consisting of vegetable butter, vegetable oil, vegetable oil fraction or a mixture thereof.

Vegetable oil according to the invention may be any oil suitable for human consumption derived from plant or algal material. Vegetable oils are generally liquid at room temperature.

Vegetable oil fraction according to the invention refers to fat composition which is obtained by fractionation of vegetable oil(s).

Vegetable butter according to the invention refers to fat ingredient suitable for human consumption derived from plant or algal material and which has the consistency of butter at room temperature.

In some embodiment, the added fat ingredient is vegetable oil and/or vegetable oil fraction. In some other embodiment, the added fat ingredient consists only of vegetable oil. For example, the added fat ingredient may be a combination of coconut oil and sunflower oil. The sunflower oil as disclosed herein may be high oleic sunflower oil. In particular, the combination of coconut oil and sunflower oil consists of 5-50% coconut oil and 50-95% of sunflower oil, preferably 10-30% coconut oil and 70-90% sunflower oil.

In an embodiment, at least 50%, preferably at least 70%, more preferably at least 80%, even more preferably at least 90% of all the fat of the dairy product analogue consist of vegetable fat. In a most preferred embodiment, all the fat of the dairy product analogue consist only of vegetable fat.

In an embodiment, at least 50%, preferably at least 70%, more preferably at least 80%, even more preferably at least 90% of all the fat of the dairy product analogue come from the added fat ingredient as disclosed herein. In a most preferred embodiment, all the fat of the dairy product analogue come from the added fat ingredient as disclosed herein. In other words, all the vegetable fat of the dairy product analogue may come from the added fat ingredient as disclosed herein.

In an embodiment, the dairy product analogue is devoid of milk fat.

In an embodiment, the dairy product analogue may comprise at least 0.1wt%, preferably at least 0.5wt% fat, more preferably at least 1wt% fat, in particular vegetable fat. In a further embodiment, the dairy product analogue may comprise at most 40wt%, preferably at most 10%, more preferably at most 5%, even more preferably at most 3.5% fat, in particular vegetable fat.

In an embodiment, the dairy product analogue may comprise at least 0.1wt%, preferably at least 0.5wt%, more preferably at least 1wt% added fat ingredient. In a further embodiment, the dairy product analogue may comprise at most 50wt%, preferably at most 10%, more preferably at most 5%, even more preferably at most 4.5%, more preferably at most 3.5wt% added fat ingredient.

In an alternative embodiment, the dairy product analogue may be free from fat. In this alternative embodiment, the dairy produce analogue is free from added fat ingredient.

In an embodiment, the dairy product analogue may further comprise an added carbohydrate ingredient. Examples of added carbohydrate ingredient include agave syrup, brown sugar, cane sugar, beet sugar, glucose syrup, coconut sugar, corn syrup, dextrose, fructose, glucose, honey, invert sugar, maltose, molasse, sucrose, maltodextrin, and mixtures thereof.

In an embodiment, the added carbohydrate ingredient is devoid of carbohydrates originated from milk, such as lactose or galactose.

In an embodiment, the dairy product analogue is free from carbohydrates originated from milk, such as lactose or galactose.

In an embodiment, the dairy product analogue may comprise least 0.1wt%, preferably 0.1 to 85wt%, more preferably 0.1 to 15wt%, more preferably 0.1 to 10wt% carbohydrates.

In an embodiment, at least 50%, preferably at least 70%, more preferably at least 80%, even more preferably at least 90% of all the carbohydrate of the dairy product analogue come from the added carbohydrate ingredient as disclosed herein.

In an embodiment, all the carbohydrate of the dairy product analogue come from the added carbohydrate ingredient as disclosed herein.

In an embodiment, the dairy product analogue may comprise least 0.1wt%, preferably 0.1 to 90wt%, more preferably 0.1 to 15wt%, more preferably 0.1 to 10wt% added carbohydrate ingredient.

In a further embodiment, the dairy product analogue may comprise additional ingredient additional ingredient selected from the list consisting of buffer salt, fiber, mineral, vitamin, added texturizing agent, color, flavor, enzyme, acidic agent different from vinegar, alkalinizing agent, fruit preparation, vegetable preparation, and mixture thereof. The dairy product analogue may comprise other additional ingredients which are not listed hereinbefore but which are suitable for food formulations.

In an embodiment, the dairy product analogue is selected from the list consisting of cream analogue, fermented dairy product analogue, ice cream analogue, non-fermented dairy dessert analogue (e.g. custard analogue, pudding analogue), milk analogue, cheese analogue, flavoured-milk analogue, milkshake analogue, coffee mix analogue, cocoa and/or malt beverage analogue and combination thereof. The dairy product analogue may be in liquid form or powder form. The fermented dairy product analogue may be spoonable fermented

dairy product analogue (e.g. spoonable yogurt analogue, spoonable kefir analogue, spoonable fresh cheese or the like) or drinkable fermented dairy product analogue (e.g. drinkable yogurt analogue, drinkable kefir analogue or the like).

In some further embodiment, the dairy product analogue is not fermented. In particular, the dairy product analogue is selected from the list consisting of cream analogue, ice cream analogue, non-fermented dairy dessert analogue (e.g. custard analogue, pudding analogue), milk analogue, cheese analogue, flavoured-milk analogue, milkshake analogue, coffee mix analogue, cocoa and/or malt beverage analogue and combination thereof and the dairy product analogue is not fermented.

In some embodiment, the dairy product analogue is not a cheese analogue. In some embodiment, the dairy product analogue is not a buttermilk analogue. In some embodiment, the dairy product analogue is not a spread. In some embodiment, the dairy product analogue is not a gel, in particular a protein gel. In some embodiment, the dairy product analogue is not tofu.In a preferred embodiment, the dairy product analogue is a beverage, in particular a liquid beverage or a powdered beverage. In this preferred embodiment, dairy the product analogue is selected from the list consisting of milk analogue, drinkable fermented dairy product analogue, milkshake analogue, milk analogue, flavoured-milk analogue, coffee mix analogue, cocoa and/or malt beverage analogue, and combination thereof. In this preferred embodiment, the dairy product analogue may be in liquid form or powder form. For avoidance of doubt, the term “beverage” when referring to dairy product analogues excludes buttermilk analogue. Indee, buttermilk analogue is generally not consumed per se as a beverage, but it is generally used as an ingredient in the manufacturing of other food products.

In some further preferred embodiment, the beverage is not fermented. In this preferred embodiment, the dairy product analogue is selected from the list consisting of milk analogue, milkshake analogue, milk analogue, flavoured-milk analogue, coffee mix analogue, cocoa and/or malt beverage analogue, and combination thereof. In this further preferred embodiment, the dairy product analogue may be in liquid form or powder form.

In a more preferred embodiment, the dairy product is a milk analogue. The milk analogue may be a powdered milk analogue or liquid milk analogue, preferably a liquid milk analogue. In this more preferred embodiment, the dairy product analogue milk analogue is preferably not fermented.

In some preferred embodiment, the dairy product analogue, preferably beverage, more preferably milk analogue is preferably plain. In particular, enhanced sensory properties

is observed even when the dairy product analogue, preferably beverage, more preferably milk analogue is plain, i.e. in the absence of flavours (e.g. coffee, chocolate, cocoa, caramel, fruit etc...).

In an embodiment, the dairy product analogue comprises less than 50wt.%, preferably less than 30wt.%, more preferably less than 20wt.%, even more preferably less than 10wt.%, even more preferably less than 5wt.%, even more preferably less than 1wt.%, even more preferably less than 0.5wt.% milk ingredients, i.e. ingredients derived from milk.In an embodiment, the dairy product analogue is free from milk ingredient.

In an embodiment, the dairy product analogue is vegetarian. In another embodiment, the dairy product analogue is vegan.

In an embodiment, the dairy product analogue is free from cocoa. In an embodiment, the dairy product analogue is free from chocolate. In an embodiment, the dairy product analogue is free from coffee. In an embodiment, the dairy product analogue is free from caramel. In an embodiment, the dairy product analogue is free from spices. Examples of spices include vanilla, cinnamon, tonka, anise, and mixture thereof. In an embodiment, the dairy product analogue is free from fruit and/or vegetables. In an embodiment, the dairy product analogue is free from pistachio flavor and/or hazelnut flavor and/or almond flavor. In an embodiment, the dairy product analogue is free from any added flavors. For avoidance of doubt, the terms “added flavors” and “fruit and/or vegetables” exclude the vinegar and the plant proteins of the dairy product analogue. The dairy product analogue prepared with vinegar retains enhanced sensory properties even in very unfavourable sensory conditions, i.e. in the absence of one or more of the foregoing ingredients (e.g. cocoa, coffee, added flavors etc.). The sensory conditions are very unfavourable in the absence of the foregoing ingredients because such ingredients may contribute to further enhance the sensory properties of dairy product analogues, for example, by masking to a certain extent the undesirable off-notes of plant proteins.In an embodiment, the dairy product analogue has a pH of 2 to 9, preferably of 4.5 to 9, more preferably of 6.5 to 8.

In a second aspect, the invention relates to a process for preparing a dairy product analogue. The dairy product analogue may be a dairy product analogue as provided in the first aspect of the invention.

The process comprises a step a) of preparing dairy product analogue which is devoid of vinegar. The dairy product analogue of step a) is a product analogue according to the first aspect of the invention but without vinegar.

The process further comprises a step b) of adding vinegar in the dairy product analogue which is devoid of vinegar to obtain a dairy product analogue. The vinegar may be a vinegar as provided in the first aspect of the invention. The dairy product analogue may be a dairy product as provided in the first aspect of the invention.

In an embodiment, at least 0.05wt%, preferably 0.05wt% to 3wt%, more preferably 0.1 to 1wt%, more preferably 0.1 to 0.5wt% vinegar is added to the dairy product analogue which is devoid of vinegar.

The vinegar is added to the dairy product analogue which is devoid of vinegar at a concentration that does not trigger curdling of the obtained dairy product analogue. The above concentrations of vinegar avoid curdling while imparting sensory improvement.

Indeed, the vinegar is mainly added to improve the sensory properties of the dairy product analogue and it is not added as curdling agent. Curdling is undesirable for the present invention as it generally leads, *inter alia*, to unwanted heterogenous and grainy texture. This is in particular undesirable for beverages.

The process comprises an optional step c) of drying the dairy product analogue to form a dairy product analogue which is in powder form. Drying technologies suitable for the invention are well known in the art. The drying step may be performed by spray drying, vacuum band drying, roller drying or freeze drying. In some embodiments, the drying step is performed by spray drying. Spray drying conditions suitable for the invention are well known in the art. In an embodiment, the step c) of drying is not optional. In an embodiment, the step c) of drying may be preceded by an evaporation step.

In a third aspect, the invention relates to a process for preparing a dairy product analogue. The dairy product analogue may be a dairy product analogue as provided in the first aspect of the invention. In some embodiment, the dairy product analogue is a beverage.

The process comprises the step a) of dispersing a plant protein ingredient with an aqueous liquid to form a plant protein dispersion.

In a preferred embodiment, the aqueous liquid is water.

The plant protein ingredient is a plant protein ingredient as provided in the first aspect of the invention.

In an embodiment, the proteins of the plant protein ingredient comprise, preferably consist of plant proteins selected from the group consisting of nut proteins (e.g. almond proteins, peanut proteins, etc.), seed proteins (e.g. hempseed proteins, sunflower seed proteins, etc.), cereal proteins, pulse proteins, fruit proteins (e.g. plantain banana proteins, coconut proteins etc.), tuber proteins (e.g. potato proteins, etc.) and combination thereof.

In another embodiment, the proteins of the plant protein ingredient comprise, preferably consist of plant proteins selected from the group consisting of nut proteins (e.g. almond proteins, peanut proteins, etc.), seed proteins (e.g. hempseed proteins, sunflower seed proteins, etc.), cereal proteins, pulse proteins, and combination thereof.

In a further embodiment, the proteins of the plant protein ingredient comprise, preferably consist of plant proteins selected from the group consisting of cereal proteins, pulse proteins, and combination thereof.

For example, the cereal proteins disclosed herein may be selected from the group consisting of oat proteins, wheat proteins, barley proteins, rice proteins, millet proteins, rye proteins, buckwheat proteins, amaranth proteins, quinoa proteins, corn proteins, sorghum proteins and combination thereof.

For example, the pulse proteins disclosed herein may be selected from the group consisting of pea proteins, faba proteins, soybean proteins, chickpea proteins, bean proteins, and combination thereof.

In an embodiment, the proteins of the plant protein ingredient comprise, preferably consist of a combination of cereal proteins and pulse proteins. The cereal proteins may be cereal proteins as disclosed herein. The pulse proteins may be pulse proteins as disclosed herein. For example, the proteins of the plant protein ingredient comprise, preferably consist of a combination of oat proteins and soybean proteins.

The plant protein dispersion obtained just after step a) comprises at least 0.5wt%, preferably 0.5 to 25wt%, more preferably 1 to 10wt%, more preferably 2 to 5wt% of proteins, preferably plant proteins.

The process further comprises an optional step b) of mixing the plant protein dispersion, in particular the plant protein dispersion of step a), with at least one additional ingredient. The additional ingredient may be selected from the list consisting of added fat ingredient, added carbohydrate ingredient, buffer salt, fiber, mineral, vitamin, texturizing agent, color, flavor, enzyme, acidic agent different from vinegar, alkalinizing agent and mixture thereof. The added fat ingredient and the added carbohydrate ingredient may be

respectively an added fat ingredient and an added carbohydrate ingredient as provided in the first aspect of the invention. In an embodiment, the additional ingredient comprise an added fat ingredient and/or an added carbohydrate ingredient. In an embodiment, the step b) is not optional.

In an embodiment, the amount of carbohydrate in the plant protein dispersion may be the same as the amount of carbohydrate as in the dairy product analogue of the first aspect of the invention.

In an embodiment, the amount of fat, in particular vegetable fat in the plant protein dispersion may be the same as the amount of fat, vegetable fat as in the dairy product analogue of the first aspect of the invention.

If the plant protein dispersion is mixed with added carbohydrate ingredient, the amount of added carbohydrate ingredient in the plant protein dispersion may be the same as the amount of added carbohydrate ingredient as in the dairy product analogue of the first aspect of the invention.

If the plant protein dispersion is mixed with added fat ingredient, the amount of added fat ingredient in the plant protein dispersion may be the same as the amount of added fat ingredient as in the dairy product analogue of the first aspect of the invention.

In some embodiment, buffer salt(s) may be dissolved in the aqueous liquid of step a) before step a).

In some embodiment, the plant protein dispersion may have the same features as the dairy product analogue of the first aspect of the invention.

In some embodiment, the process may comprise a step of treating enzymatically the plant protein dispersion with at least one enzyme between step a) of dispersion and step b) of mixing or between step a) of dispersion and step c) of homogenization (if step c) of homogenization is before step d) of heat treatment) or between step a) of dispersion and step d) of heat treatment (if step c) of homogenization is after the step d) of heat treatment). In an embodiment, the enzyme comprises an amylase activity or side activity.

The pH of the plant protein dispersion obtained after step a) or b) may be adjusted to reach a pH of 6.0 to 8.0, preferably 6.8 to 7.5. This step of pH adjustment is before the step c) of homogenization, when the step c) of homogenization is before the step d) of heat treatment. Alternatively, this step of pH adjustment is before the step d) of heat treatment, when the step d) of heat treatment is before the step c) of homogenization.

The process further comprises a step c) of homogenizing the plant protein dispersion, in particular the plant protein dispersion obtained after step a) or after step b) (if any step b)) of after step d) (if step d) is before step c)). The homogenization step may be performed at a pressure above 50 bar. Preferably, the homogenizing step may be performed at a pressure of 50 bar to 700 bar. Further preferably, the homogenizing step may be performed at a pressure of 50 bar to 500 bar. More preferably, the homogenizing step may be performed at a pressure of 50 to 400 bar, from 100 to 400 bar or from 150 to 400 bar.

In a preferred embodiment, the homogenization step may be performed at a temperature from 50°C to 75°C. More preferably, the step may be performed at a temperature from 55°C to 75°C.

The process further comprises a step d) of heat treating the plant protein dispersion to obtain a dairy product analogue. The heat treatment step may be performed by direct or indirect heat treatment. The heat treatment step may be performed with any heat treatment technologies suitable for food products. For example, the heat treatment step may be performed by pasteurization, sterilization or ultra-high temperature (UHT) treatment. For example, the heat treatment step may be performed at a temperature of 75 to 150°C for 2 seconds to 5 minutes.

The step d) of heat treatment may be before or after the step c) of homogenization. If the step d) of heat treatment is before the step c) of homogenization, the dairy product analogue is obtained after the step c) of homogenization.

In an embodiment, the process may comprise two steps of homogenization, i.e. the step c) of homogenization which is before the step d) of heat treatment and an additional step c') of homogenization which is after the step d) of heat treatment. In this embodiment, the dairy product analogue is obtained after the step c') of homogenization. If there is a step e) of drying, the step c') of homogenization is before the step e) of drying.

The method further comprises the optional step e) of drying the dairy product analogue to form a dairy product analogue which is in powder form. Drying technologies suitable for the invention are well known in the art. The drying step may be performed by spray drying, vacuum band drying, roller drying or freeze drying. In some embodiments, the drying step is performed by spray drying. Spray drying conditions suitable for the invention are well known in the art. In an embodiment, the step e) of drying is not optional.

In an embodiment, the process may comprise a step of evaporating the dairy product analogue after step c) of homogenization or after step c') of homogenization or after step d)

of heat treatment. If there is a step e) of drying, the step of evaporation is before the step of e) of drying. This step allows to concentrate the dairy product analogue. In processes with a step of drying, this step of evaporation facilitates the consecutive drying step.

The process comprises a step of adding vinegar in the plant protein dispersion and/or the dairy product analogue. The vinegar may be a vinegar as provided in the first aspect of the invention.

The vinegar may be added in the plant protein dispersion between the step a) of dispersion of the plant protein ingredient and the step c) of homogenization, if the step c) of homogenization is before the step d) of heat treatment. Alternatively, the vinegar may be added in the plant protein dispersion between the step a) of dispersion of the plant protein ingredient and the the step d) of heat treatment, if the step d) of heat treatment is before the step c) of homogenization. In some embodiment, the vinegar may be added in the plant protein dispersion during step b) with the additional ingredients.

Alternatively, the vinegar may be added in the dairy product analogue after step c) of homogenization, if the step c) of homogenization is after the step d) of heat treatment, or after the step d) of heat treatment, if the step d) of heat treatment is after the step c) of homogenization. When there are two steps c) and c') of homogenization, the vinegar is added in the dairy product analogue after the step c') of homogenization. When there is a step of evaporation, the vinegar may be added in the dairy product analogue after the step of evaporation or just before the step of evaporation, i.e. between the step just before the evaporation (i.e. step c), c') or d)) and the step of evaporation. In this alternative embodiment, the vinegar is preferably added in the dairy product analogue before the step e) of drying.

When the vinegar is added in the dairy product analogue, the dairy product analogue according to the invention is obtained after the addition of such a vinegar. This is in particular the case when the vinegar is added in the dairy product analogue in the final step of the process or in the step which is just before the drying step d).

In some embodiment, the vinegar at least 0.05wt%, preferably 0.05wt% to 3wt%, more preferably 0.1 to 1wt%, more preferably 0.1 to 0.5wt% is added to the dairy product analogue.

The vinegar is used at a concentration that does not trigger curdling of the plant protein dispersion and dairy product analogue. The above concentrations of vinegar avoid curdling while imparting sensory improvement.

Indeed, the vinegar is mainly added to improve the sensory properties of the dairy product analogue and it is not added as curdling agent. Curdling is undesirable for the present

invention as it generally leads, *inter alia*, to unwanted heterogenous and grainy texture. This is in particular undesirable for beverages.

The processes of the second and third aspect of the invention result in dairy product analogues, in particular milk analogues, with improved sensory properties. The use of vinegar such processes improves the taste of dairy product analogues. Without wishing to be bound by theory, it is believed that the texture of dairy product analogues may also be improved by the use of vinegar in such processes.

Those skilled in the art will understand that they can freely combine all features of the present invention disclosed herein. In particular, features described for the product of the present invention may be combined with the processes of the present invention and vice versa. Further, features described for different embodiments of the present invention may be combined.

Furthermore, where known equivalents exist to specific features, such equivalents are 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

Example 1: Preparation of milk analogues with or without vinegar

Different milk analogues were prepared as follows.

A first part of the buffer salts (i.e. 94.6% of the total buffer salt content provided in table 1) was dissolved in water at 65°C for 5 minutes to obtain an aqueous substrate. Then, the oat flour and soy flour were dispersed in the aqueous substrate at 85-90°C for 10 minutes to obtain a plant protein dispersion. The plant protein dispersion is hydrolyzed with amylase at 65-70°C for 10 minutes to obtain a hydrolyzed plant protein dispersion. All other ingredients (except remaining buffer salt) were then mixed with the hydrolyzed plant protein dispersion at 65°C for 2-5 minutes. After mixing with the different ingredients, the pH of the hydrolyzed plant protein dispersion was between 6.8 -7.5 and the remaining part of buffer salts was added to the hydrolyzed plant protein dispersion to maintain the pH in this range. Thereafter, the hydrolyzed underwent homogenization at 50-60°C, 360 bars followed by UHT heat

treatment at 143°C for 5 seconds and finally followed by homogenization at 75°C, 250 bars to obtain milk analogue.

The recipe of the milk analogue is provided in table 1. The milk analogue has a total protein content of 2.2%, a total fat content of 2.5% and a total sugar content of 0.8%.

Ingredients	Amount (wt%)
water	88.26
Oat flour (19wt% protein)	4.82
Soy flour (51wt% protein)	2.78
High oleic sunflower oil	2.00
Coconut oil	0.45
Enzyme	0.05
Sucrose	0.80
Texturizing agent	0.10
Buffer salts	0.74

Table 1

The obtained milk analogue was not further processed and was not in particular mixed with any vinegar to form the reference milk analogue (=ref MA). Alternatively, the obtained milk analogue was mixed with different vinegars to form milk analogues according to the invention. In particular, it was mixed with 0.40% rice vinegar (=MA1) or 0.40% white balsamic vinegar (=MA2) or 0.20% dark balsamic vinegar (=MA3) or 0.20% apple vinegar (=MA4).

Example 2: Sensory assessment for the milk analogue

The different milk analogues, i.e. ref MA and MA1-MA4 were assessed by 7 people trained to assess the sensory attributes of milk analogues. In particular, the sensory profile, including flavor profile of MA1-MA4 was described by the different judges in comparison with the sensory profile of the reference milk analogue ref MA.

For MA1-MA4, the different vinegars were added on the day of or 1 day before the sensory assessment.

The results are shown in table 2.

Sample	**Ref MA**	**MA1**	**MA2**	**MA3**	**MA4**

Type of vinegar	.	Rice vinegar	White balsamic vinegar	Dark balsamic vinegar	Apple vinegar
Level of vinegar	0	0.40	0.40	0.20	0.20
Judge 1	Cereal, sweet, Powdery	Less cereal, Sweet, Powdery	Strong decrease of cereal notes, Fruity	No cereal, Bread, Round flavor, Sweet	Less cereal, Slight vinegar taste/ acid, Sweet
Judge 2	Cereal, Sweet	Less cereal	Less cereal, Weak flavor	Less cereal, Floral	Less cereal, Vinegar
Judge 3	NA	Neutral flavor, Less cereal	Fruity, Less cereal	Balsamic, Less cereal	Pleasing taste, Less cereal
Judge 4	NA	Sour cream	NA	Some fruity, Buttery	Less plant-based, More dairy
Judge 5	NA	Less green, Neutral, A bit sweeter	No green, strong flavor identity (fruity)	Less green, A bit fruity, Sweeter	Balsamic
Judge 6	Cereal	Less aftertaste, Clean, Slight acidic	More mouthfeel ,Clean	Cleaner, More neutral	Creamy, Buttery, Fresh
Judge 7	NA	More cereal	More fruity	Less green, Fatty/buttery	More cereal

Table 2

It can be observed that the sensory profile, in particular the flavor profile of the ref MA is modified when vinegar is added. Overall, the sensory properties of milk analogue is improved when vinegar is added (cf. MA1-MA4). Green/ cereal notes are decreased; and other aromatic directions are increased (dairy/ buttery, fruity, etc).

The mouthfeel seems as well improved as well for MA1-MA4, with less “powdery” sensation.

Example 3: Volatile composition of different vinegars

Material and Method:

Volatile composition of the rice vinegar, white balsamic vinegar, dark balsamic vinegar and the apple vinegar was screened. Aroma compounds were analyzed by headspace-solid phase microextraction gas-chromatography mass-spectrometry (HS-SPME-GC-MS). The HS-SPME-GC-MS analyses were performed as follows.

Sample prep – vinegar prototypes

995µL of water and 5µL of each vinegar was transferred to a 10mL GC vial. The final concentration of vinegar in water in the vial is 0.5%. The preparation is done in triplicate.

Sample prep – milk analogues prototypes

1mL of each milk analogue was transferred to a 10mL GC vial. The preparation is done in triplicate.

RTC PAL autosampler

A RTC PAL autosampler was used to sample the headspace of liquid samples using SPME (solid phase microextraction) technique. The fiber used was a PDMS/DVB 65um, 1cm (supplier: Supelco, ref: 57345-U).

Vials were placed in the sample tray cooled at 12°C before analysis. Then transported in the incubator heated at 40°C for 5min for temperature stabilization before sampling with the SPME fiber for 10min. SPME fiber was then desorbed into the GC-MS (gas chromatography mass spectrometry) inlet at 250°C for 5min.

Gas chromatography – mass spectrometry

These vials were measured on a GC/MS Agilent (Number) in SCAN mode. The GC-MS was equipped with a DBWAX capillary column (60m long, 0.25mm internal diameter and 0.25um fil thickness). Helium was used as carrier gas at constant flow rate of 2ml/min. Then oven temperature was held 5min at 35°C then increased at 4°C/min until 230°C for 10min. The inlet injector heated at 250°C, was on splitless mode for 3min then the split was open at 50ml/min. The MS operated in SCAN mode (m/z 29-300).

Aroma compounds were categorized by chemical family (figures 1, 2, 3 and 4). No quantitative analysis was performed.

Results:

The results are shown in figures 1-4. Figures 1-2 show the volatile aroma compound composition for different type of vinegars. Figures 3-4 show the volatile aroma compound composition for different milk analogues prepared without vinegar or with different types of vinegar.

It can be seen that the chemical profiles for the flavor intensity (height of the total bar) and profile (subdivision of the block) are different between the type of vinegar used, as well as between milk analogues prepared with such vinegar.

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 of the invention as defined in the claims.

Example 4: Sensory assessment of milk analogues prepared with different vinegar

Material and Method

Preparation of milk analogues

A milk analogue was prepared as follows.

A first part of the buffer salts (i.e. 94.6% of the total buffer salt content provided in table 3) was dissolved in water at 65°C for 5 minutes to obtain an aqueous substrate. Then, the soy flour was dispersed in the aqueous substrate at 85-90°C for 10 minutes to obtain a plant protein dispersion. All other ingredients (except remaining buffer salt) were then mixed with the plant protein dispersion at 65°C for 2-5 minutes. After mixing with the different ingredients, the pH of the plant protein dispersion was between 6.8 -7.5 and the remaining part of buffer salts was added to the plant protein dispersion to maintain the pH in this range. Thereafter, the plant protein dispersion underwent homogenization at 50-60°C, 360 bars followed by UHT heat treatment at 143°C for 5 seconds and finally followed by homogenization at 75°C, 250 bars to obtain milk analogue.

The recipe of the milk analogue is provided in table 3. The milk analogue has a total protein content of 2.2%, a total fat content of 2.5% and a total sugar content of 0.8%.

Ingredients	Amount (wt%)
water	91.37
Soy flour (51 wt% protein)	4.64
High oleic sunflower oil	2.45
Sucrose	0.80
Buffer salts	0.74

Table 3

The obtained milk analogue was not further processed and was not in particular mixed with any vinegar to form the reference milk analogue (=ref MA2). Alternatively, the obtained milk analogue was mixed with different vinegars to form milk analogues according to the invention. In particular, it was mixed with 0.20% dark balsamic vinegar (=MA5) or 0.20% apple vinegar (=MA6).

Sensory evaluation

The different milk analogues, i.e. ref HMA2, MA5, MA6 were assessed under red light by 9 people trained to assess the sensory attributes of milk analogues. RATA (Rate All That Apply) methodology was used to describe different sensory attributes for the samples with a 0 to 5 scoring scale (0 = not perceived, 1 = just noticeable, 2 = slightly perceived, 3 = moderately perceived, 4 = much perceived, 5 = very much perceived). An average score for each attribute was calculated based on the different scores provided by the 9 tasters that assessed the different hybrid milk analogues.

Results

The results are shown in Figure 5.

It can be observed that the sensory profile, in particular the flavor profile of the ref MA2 is modified with the addition of vinegar. Overall, the sensory properties of the milk analogue is improved when vinegar is added (MA5, MA6). Pulse notes are decreased while dairy, nutty and/ or sweet note is increased. The mouthfeel seems modified as well for MA6, with less astringency.

Example 5: Sensory assessment of hybrid milk analogues prepared with vinegar

Material and Method:

Preparation of hybrid milk analogues

Different hybrid milk analogues were prepared to assess the impact of vinegar on their sensory properties.

A reference hybrid milk analogue (= ref HMA) was obtained by the addition of 0.2% skimmed milk powder and 1% additional fat source (i.e. sunflower oil and coconut oil) to the milk analogue described in example 1 (=ref MA).

The reference hybrid milk analogue ref HMA was mixed with 0.2% apple vinegar to obtain hybrid milk analogue HMA1.

Table 4 shows the composition of the different hybrid milk analogues (ref HMA, HMA1); all samples were prepared on the day prior to the sensory assessment.

	Ref HMA	HMA1
Ref MA	100%	100%
Skimmed milk powder	0.20%	0.20%
Sunflower oil	0.74%	0.74%
Coconut oil	0.26%	0.26%
Apple vinegar		0.20%

Table 4

Sensory evaluation

The different hybrid milk analogues, i.e. ref HMA and HMA1 were assessed under red light by 10 people trained to assess the sensory attributes of hybrid milk analogues. RATA (Rate All That Apply) methodology was used to describe different sensory attributes for the samples with a 0 to 5 scoring scale (0 = not perceived, 1 = just noticeable, 2 = slightly perceived, 3 = moderately perceived, 4 = much perceived, 5 = very much perceived). An average score for each attribute was calculated based on the different scores provided by the 10 tasters that assessed the different hybrid milk analogues.

Results

The results are shown in Figure 6.

It can be observed that the sensory profile, in particular the flavor profile of the ref HMA is modified with the addition of apple vinegar. Overall, the sensory properties of the hybrid milk analogue are improved when apple vinegar is added (HMA 1). Pulse notes are

decreased while dairy, cereal notes and sweetness are increased. The mouthfeel seems modified as well for HMA 1, with lower astringency.

CLAIMS

1. A dairy product analogue which comprises plant proteins and vinegar.

2. A dairy product analogue according to claim 1, wherein the vinegar is selected from the group consisting of rice vinegar, balsamic vinegar, white wine vinegar, red wine vinegar, apple cider vinegar, malt vinegar, champagne vinegar, sherry vinegar, black vinegar, cane vinegar, beer vinegar, raspberry vinegar, honey vinegar, fruit vinegar, and mixture thereof.

3. A dairy product analogue according to any one of the preceding claims, which further comprises an added fat ingredient.

4. A dairy product analogue according to any one of the preceding claims, wherein the plant proteins comprise, preferably consist of plant proteins selected from the group consisting of cereal proteins, pulse proteins and combination thereof.

5. A dairy product analogue according to any one of the preceding claims, comprising at least 0.5wt% plant proteins.

6. A dairy product analogue according to any one of the preceding claims, comprising at least 0.05wt% vinegar.

7. A dairy product analogue according to any one of the preceding claims, which is beverage.

8. A dairy product analogue according to claim 7, wherein the beverage is a liquid beverage or powdered beverage.

9. A dairy product analogue according to any one of the preceding claims, which is free from milk ingredients.

10. A dairy product analogue according to any one of the preceding claims, wherein the dairy product analogue is a liquid milk analogue or powdered milk analogue.

11. A dairy product analogue according to any one of the preceding claims, wherein the dairy product analogue is plain.

12. A process for preparing a dairy product analogue with vinegar comprising the steps of:
a) preparing a dairy product analogue which is devoid of vinegar,
b) adding vinegar in the dairy product analogue devoid of vinegar to obtain a dairy product analogue.

13. A process for preparing a dairy product analogue comprising the steps of :
a) dispersing a plant protein ingredient with an aqueous liquid to form a plant protein dispersion,
b) optionally, mixing the plant protein dispersion of step a) with additional ingredients,
c) homogenizing the plant protein dispersion,
d) heat treating the plant protein dispersion to obtain a dairy product analogue,
e) optionally, drying the dairy product analogue,
wherein a vinegar is added in the plant protein dispersion and/or the dairy product analogue,
preferably the vinegar is added:
-in the plant protein dispersion between step a) and c), or
-in the dairy product analogue after step d), when step d) is after step c), or
-in the dairy product analogue after step c), when step c) is after step d).

14. A process according to claim 12 or 13, wherein the dairy product analogue is a dairy product analogue according to any one of claims 1 to 11.

15. A process according to any one of claims 12 to 14, wherein the dairy product analogue is a beverage.

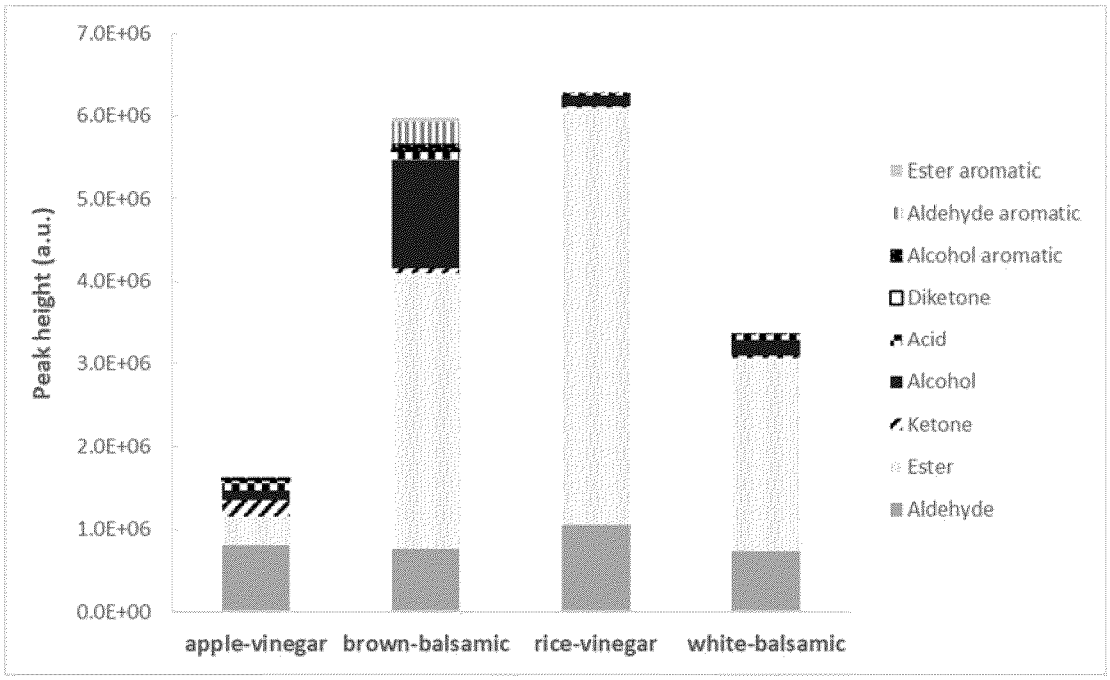


FIGURE 1

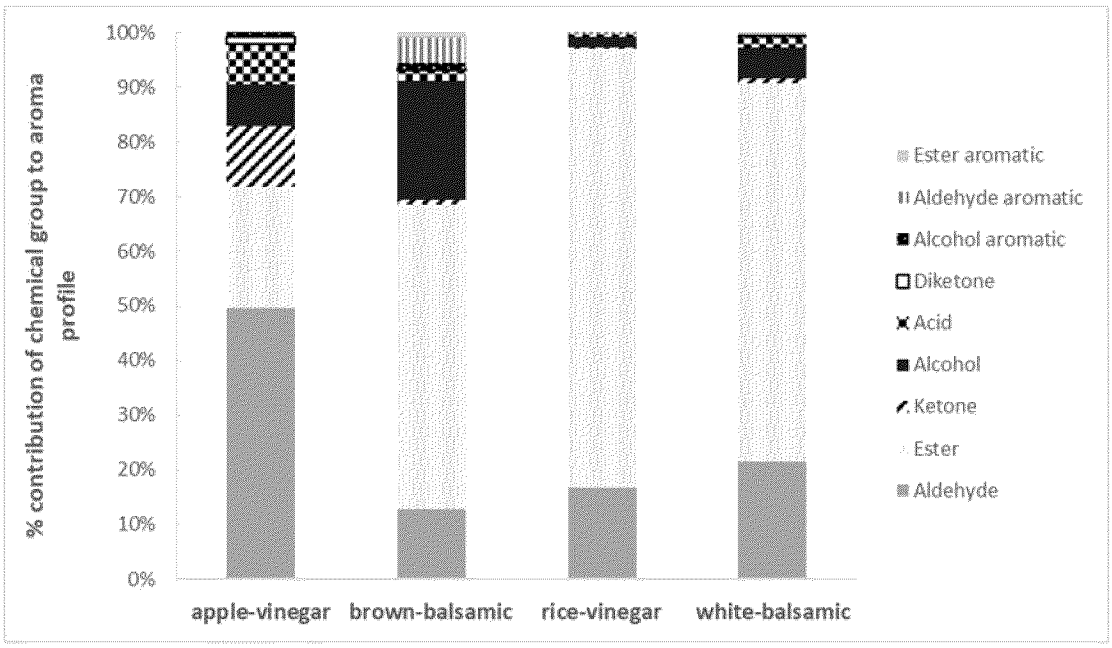


FIGURE 2

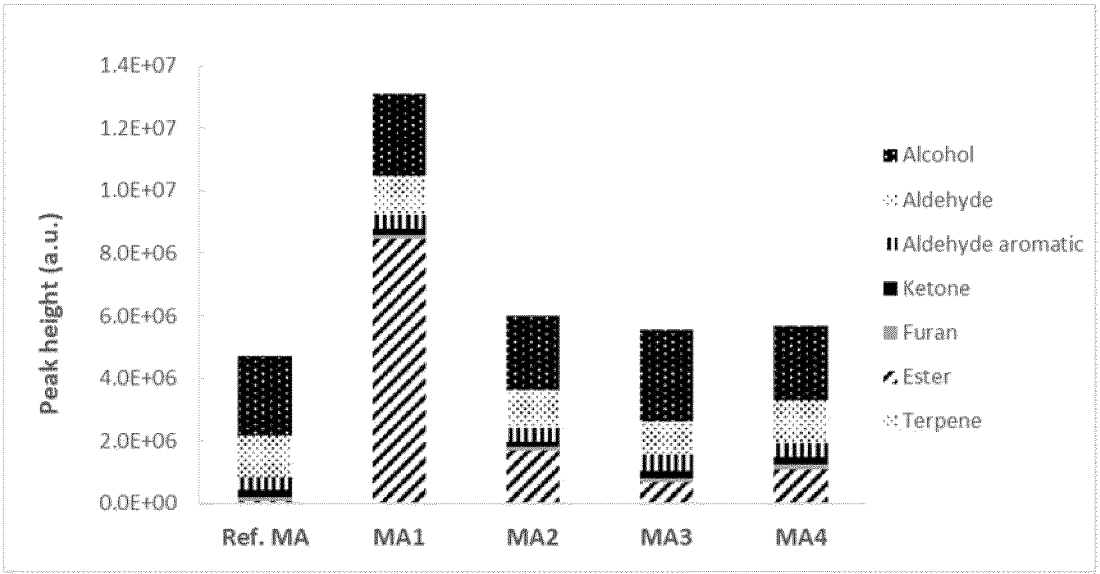


FIGURE 3

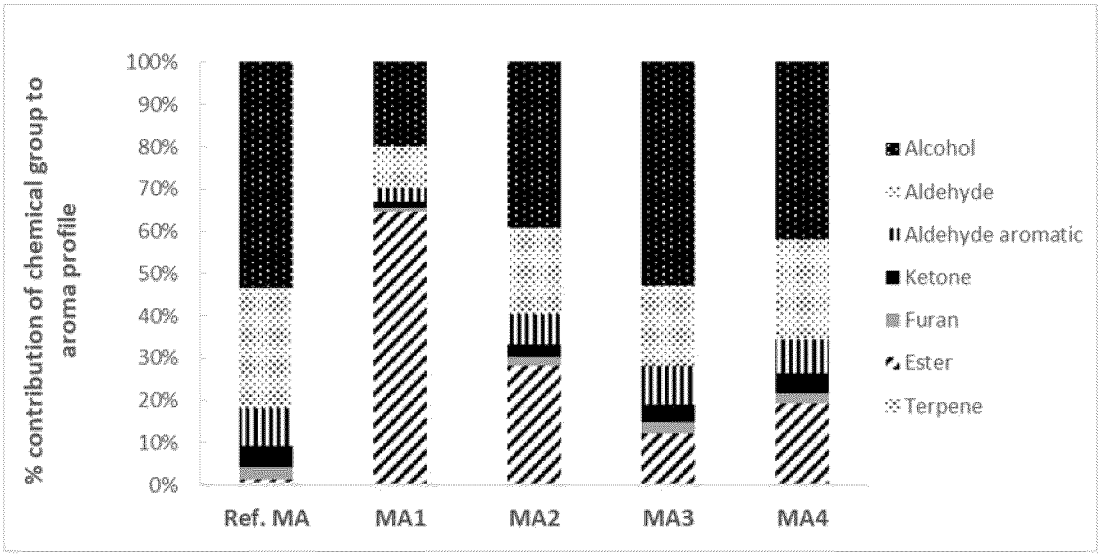


FIGURE 4

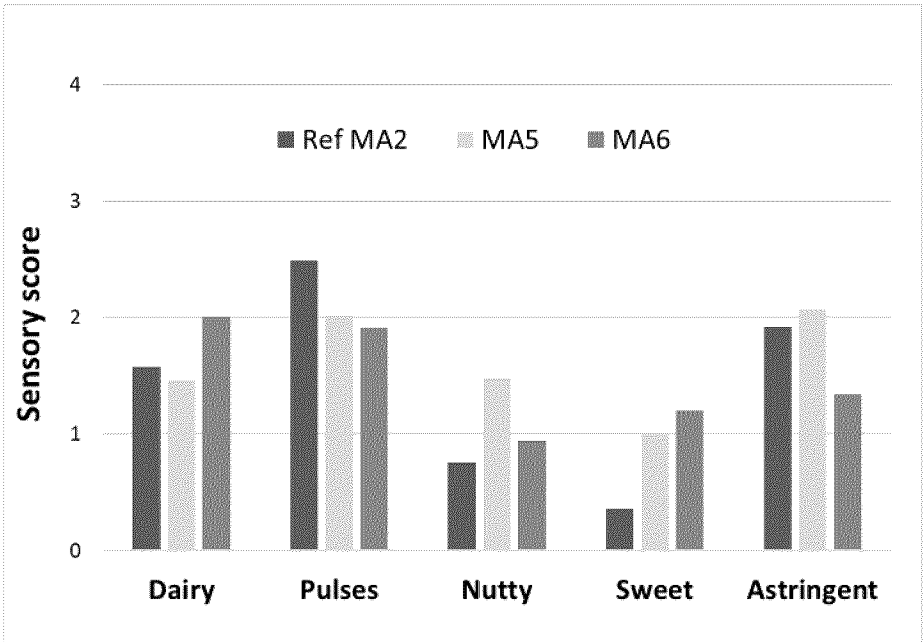


FIGURE 5

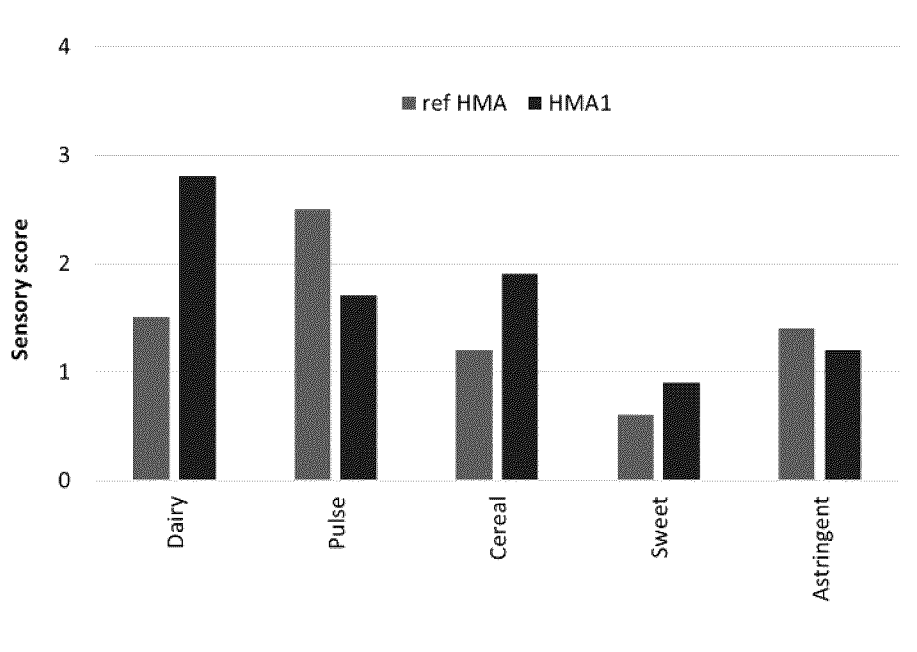


FIGURE 6

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2024/068964

A. CLASSIFICATION OF SUBJECT MATTER

INV. A23C11/06 A23C11/10 A23C20/00 A23C20/02 A23L2/39
A23L2/66 A23L9/20 A23L11/50 A23L11/60 A23L11/65
A23L27/24

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

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

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2008/181990 A1 (LEDBETTER KATI R [US] ET AL) 31 July 2008 (2008-07-31) examples 4,5,6	1-6,8,9, 11,12,14
X	Anonymous: "How to make vegan buttermilk (in less than 5 minutes!)", , 7 April 2022 (2022-04-07), pages 1-14, XP093112457, Retrieved from the Internet: URL:https://thebananadiaries.com/vegan-buttermilk-recipe/ [retrieved on 2023-12-14] the whole document	1-15

-/--

[x] Further documents are listed in the continuation of Box C.

[x] See patent family annex.

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20 September 2024	22/10/2024

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Krajewski, Doris

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C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	DATABASE GNPD [Online] MINTEL; 1 June 2021 (2021-06-01), anonymous: "Coffee Flavoured Slim Shake for Weight Control", XP093109605, Database accession no. 8747785 the whole document -----	1-5,7,8, 10-15
X	DATABASE GNPD [Online] MINTEL; 6 April 2023 (2023-04-06), anonymous: "Belgian Chocolate Flavoured Meal Replacement Lean Shake", XP093109603, Database accession no. 10710890 the whole document -----	1-5,7-15
X	DATABASE GNPD [Online] MINTEL; 5 June 2023 (2023-06-05), anonymous: "Spicy Hummus", XP093109613, Database accession no. 10849852 the whole document -----	1-6,9, 11,12,14
X	DATABASE GNPD [Online] MINTEL; 30 June 2023 (2023-06-30), anonymous: "Greek White Plant-Based Preparation", XP093109591, Database accession no. 10924430 the whole document -----	1-6,9, 11,12,14

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/EP2024/068964

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2008181990 A1	31-07-2008	US 2008181990 A1	31-07-2008
		WO 2008094434 A2	07-08-2008