TASTE AND FLAVOUR MODULATION BY BIOTRANSFORMATION IN MILK PRODUCTS

Abstimmung von Geschmack und Aroma in Milchprodukten durch Biotransformation

Modulation du goût et de l'arôme de produits laitiers par biotransformation

Designated Contracting States:
AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HU IE IS IT LI LT LU LV MC MT NL PL PT RO SE SI SK TR

Priority: 23.10.2006 EP 06022153

Date of publication of application: 05.08.2009 Bulletin 2009/32

Divisional application: 11159520.3 / 2 366 293

Proprietor: Nestec S.A.
1800 Vevey (CH)

Inventor: BRAUN, Marcel
3510 Konolfingen (CH)

Representative: Künzi, Sophie et al
Nestec S.A.
CT-IAM
Avenue Nestlé 55
1800 Vevey (CH)

References cited:
EP-A2- 1 186 244 WO-A-02/085131
DE-C- 148 419 GB-A- 823 556

• DATABASE WPI Week 200463 Derwent Publications Ltd., London, GB; AN 2004-642997
XP002422094 & CN 1 506 108 A (QI H) 23 June 2004 (2004-06-23)

Remarks:
The file contains technical information submitted after the application was filed and not included in this specification

Note: Within nine months of the publication of the mention of the grant of the European patent in the European Patent Bulletin, any person may give notice to the European Patent Office of opposition to that patent, in accordance with the Implementing Regulations. Notice of opposition shall not be deemed to have been filed until the opposition fee has been paid. (Art. 99(1) European Patent Convention).
Description

Field of the invention

[0001] The present invention relates to a method for promoting natural tastes and flavours in milk-based products.

Background of the invention

[0002] Traditionally, in the production of milk products such as cheese, butter etc., the characterising flavours are developed during fermentation of the milk source with bacteria.

[0003] In recent years, novel flavouring agents which can be added to milk products for taste improvement have been developed. These flavouring agents are traditionally obtained by treating a milk source with enzymes, microorganisms etc. For instance, a number of publications describe fermentation of a milk source with microorganisms and enzymes such as lipases, proteases etc. to produce aromas which can be isolated and used in the manufacture of flavoured milk products such as cheese, milk, fermented milk etc. Amongst these publications are CA 1220075, EP 137536, JP 2003-250482, JP 3127962, JP 5049385, JP 2002-142713, JP 5091851, JP 58043755, JP 6125733, JP 64002549, EP 1053689, EP 1186244, US 3858492, JP 74015785, JP 2004-267126, JP 6319448, US 6635303 B1, JP 800-43742, JP 2005-151895, JP 30120942, JP 1510784, JP 2004-236638, JP 4169166, JP 9037735, US 3975544, WO 0147366. The flavours thus obtained are described as "dairy" flavours and therefore act as flavours enhancers to dairy products.

[0004] However, there are limited reports on using a process similar to that described above in order to provide flavours distinct from "dairy" flavours such as, for example, chocolate, fruity flavours etc.

[0005] A document by Ravula R. R. et al. (Australian journal of dairy technology, 1998, vol. 53, No. 3, pp. 175-179) is titled "Effect of acid casein hydrolysate and cysteine on the viability of yoghurt and probiotic bacteria in fermented frozen dairy desserts". The document by Ravula R. R. et al. describes the effect of acid casein hydrolysate and cysteine on the viability of yoghurt bacteria (Streptococcus salivarius ssp. thermophilus and Lactobacillus delbrueckii ssp. bulgaricus) and probiotic bacteria (Lactobacillus acidophilus and bifidobacteria) during a storage period of 12 weeks was assessed in fermented frozen dairy desserts.

[0006] EP 1186244 describes a natural biogenerated cheese flavoring system which can be used to prepare very different cheeses having desired flavor profiles. More specifically, the cheese flavoring system comprises a sulfury-cheddar flavored component, a creamy-buttery flavored component, and a cheesy flavored component. Each of these flavored components can be used as flavor building blocks with their own specific flavor profiles and/or characteristics. Using various combinations of the flavored components, cheeses having a wide variety of flavors can be produced. The flavored components are separately prepared from a highly concentrated milk substrate using compositions (e.g., specific enzymes, cultures, and additives) and process conditions designed to provide the flavored components having specific flavor profiles and/or characteristics. The flavor concentrates can be used in process cheese, process cheese-type products, or other cheeses to produce very different cheeses with desired flavor profiles. The flavor concentrates can also be used as a natural flavoring system in other food products.

[0007] DE 23 62 998 describes a process which involves the proteolysis of a milk product with enzymes or micro-organisms optionally followed by fermentation of the milk product using bacteria such as Lactobacillus or Streptococcus. This pre-treated milk product is then heated in the presence of cystein and the resulting product contains a high concentration of flavouring agent and can be dried or used as a solution of paste.

[0008] WO 02/00845 describes a way to obtain chocolate-flavoured fermented products by fermenting a milk source with a mixed micro-organism culture. This method is however of limited scope in terms of the flavours obtained and in terms of the applications.

[0009] US 6,75,193 (also CA 1220075) describes a two-stage process for producing a cheese-flavored substance. A flavor development medium is fermented with a source of lipase/protease; the source of lipase/protease is inactivated and the flavor development medium is fermented at least one lactic acid-producing microorganism which is thereafter inactivated. The source of lipase/protease is preferably a microorganism, especially Candida lypolitica ATCC 20234. The cheese-flavored substance produced by the process and foods containing the cheese-flavored substance produced by the process are also described.

[0010] WO 20085131 describes a method that produces a savoury flavoured product from a source of protein fusing a combination of two distinct strains of bacteria. The source of protein may be a plant soy, wheat or rice- but is preferably milk or whey. The first strain of bacteria is selected from the group Micrococcus, Micrococccus, Enterococcus, Staphylococcus, Brevibacterium, Anthrobacter and Corynebacterium, preferably Micrococcus caseolyticus. The second strain of bacteria is selected from the lactic acid bacteria - Lactococcus, Lactobacillus, Pediococcus or Leuconostoc. Then protein source is fermented with the bacteria at a pH above the isoelectric point of the protein, preferably at a pH of 5.5-6.5. The savoury flavoured product may be combined with other ingredients to form products such as cheese, protein-water gels, yoghurt, creams, custards, sauces and confectionary products.

[0011] US 5 385 743 describes a process for the preparation of a yoghurt flavor. The process comprising the fermentation of a whey medium comprising water and...
whey solids with a conventional bacterial yoghurt starter culture.

[0012] DE 148 419 discloses the production of an artificial meat extract from skimmed milk comprising the step of proteolysis of skimmed milk, followed by acidification and heating (in order to cleave the lactose present in the milk). The mixture is then treated with yeast and then optionally salted and also optionally dried.

[0013] US 3 858 492 discloses that the flavor of milk foodstuffs is enhanced with a good dairy flavor by contacting the foodstuff with an enzyme-containing substance derived from a microorganism belonging to the Basidiomycetes group.

[0014] A document by Al-Rugaie et al. (Journal of Dairy Research, Vol. 50, Issue 03, August 1987, pp 429-434) is titled "Improvement in the quality of the dried fermented milk product, oggtt". The document by Al-Rugaie et al. describes a preparation of a dried fermented milk product, wherein a pasteurised milk is fermented using a starter culture of Lactobacillus bulgaricus and Streptococcus thermophilus. The fermentation is terminated by boiling or by adding salt and the product is dried to a moisture content of less than 10 %. The final product may comprise the addition of a flavour component.

[0015] A document by Marshall et al. (Journal of Dairy Research, Vol. 50, Issue 03, August 1983, pp 375-379) is titled "Threonine aldolase and alcohol dehydrogenase activities in Lactobacillus bulgaricus and Lactobacillus acidophilus and their contribution to flavour production in fermented milks". The document by Marshall et al. describes cell-free extracts of both Lactobacillus bulgaricus and L. acidophilus demonstrated threonine aldolase activity, the end product of which was acetaldehyde, the major flavour compound of yoghurt. L. acidophilus also possessed an alcohol dehydrogenase activity capable of reducing acetaldehyde so that little yoghurt flavour was present in milks fermentation with this organism. Addition of threonine to fortified milk before fermentation with L. acidophilus increased acetaldehyde production and resulted in a well flavoured product similar to that of yoghurt made with L. bulgaricus. The contribution of these 2 enzymes to flavour production is described.

[0016] In order to achieve a variety of different, distinct flavours, artificial synthetic flavourings are normally added to the milk products. The use of artificial flavourings is quite often linked with a negative impression by the consumers.

[0017] There is thus a need to provide a wide variety of flavours in a natural way which can be used in a wide range of foods, and which thus avoids the use of artificial flavourings.

Summary

[0018] Accordingly, the present object is achieved by means of the features of the independent claims. The dependent claims develop further the central idea of the invention.

[0019] The present invention proposes in a first aspect a method to promote a non-savoury flavour in a food product, comprising the steps of:

a) adding at least one amino acid to a milk source, wherein the amino acid is selected from phenylalanine, leucine, isoleucine; valine and mixtures thereof,

b) adding at least one micro-organism to the milk source, wherein the micro-organism produces at least one enzyme capable of converting the amino acid(s),

c) fermenting the milk source, wherein the released enzyme(s) react(s) with the amino acid(s) present in the fermentation mixture to provide direct or indirect conversion products which are responsible for a particular flavour, wherein the flavour is a non-savoury flavour,

d) adding a lipase and lactase in the form of enzyme preparations or in the form of immobilized enzymes, prior to and/or during and/or after fermentation

e) optionally drying the fermented milk source and

f) adding said fermented milk source to the food product.

Figures

[0020] The present invention is further described hereinafter with reference to some of its embodiments shown in the accompanying drawings in which:

- Fig. 1 is a flow-chart showing method steps in the production of a sweet honey or sweet honey and cream butter flavoured milk powder.

- Fig. 2 is a flow-chart showing method steps in the production of a malt and chocolate or a malt, chocolate and honey flavoured milk powder. (not according to invention)

- Fig. 3 depicts a series of chemical reactions which may lead to compounds responsible for the honey flavour.

- Fig. 4 depicts a series of chemical reactions which may lead to compounds responsible for a cocoa and malt flavour.

- Fig. 5 depicts a chemical reaction which may lead to compounds responsible for a cocoa/coffee flavour. (not according to invention)

- Fig. 6 is a flow-chart showing method steps in the production of a liquid flavouring product.

Detailed description of the invention

[0021] The present invention is concerned with the production of natural flavours which can be used in a number of food applications.

[0022] Thus, the invention relates, in a first aspect, to a method to promote a non-savoury flavour in a food product. By "non-savoury" flavour is meant a flavour
which is not savoury, i.e. not salty, spicy, sharp etc. A typical savoury flavour would be a cheesy, meaty, salty flavour. However, the invention does not relate to such flavours but to “non-savoury” flavours. The flavours of the present invention thus include “sweet”, creamy etc. flavours. Additionally, the flavours of the invention preferably do not include yogurt flavours.

[0023] In a preferred embodiment, the flavour is selected from honey, caramel, cocoa, malt, cream-caramel, sweet-honey cream, cocoa-cream, coffee, cream, butter, vanilla, nutty, chocolate and any combination or sub-combination thereof.

[0024] Such method for promoting said non-savoury flavour in a food product involves, in a first step, the addition of at least one amino acid to a milk source.

[0025] In the present invention, the enzymes may be provided as such, in the form of enzyme preparations, in the form of immobilised enzymes and may even be provided by appropriate micro-organisms.

[0026] The amino acid is selected from phenylalanine, leucine, isoleucine, valine and mixtures thereof.

[0027] The amino acid may be added to then milk source in an amount of 0.01 to 5 wt%, preferably 0.01-2 wt%, more preferably in an amount of 0.03-1.0 wt%, most preferably 0.05-0.3 wt% on dry matter.

[0028] In a preferred embodiment, a source of alpha-keto acid, such as alpha-ketoglutarate, alpha-ketoisocaproate, alpha-ketoisovalerate, similar amino acceptors or mixtures thereof may also be added to the milk source. Preferably, alpha-ketoglutarate is used. These naturally occurring compounds help contribute to the enzymatic pathway of the amino acid, as occurs in the subsequent steps of the present method.

[0029] Optionally, cofactors for improving fermentation efficiency such as manganese or magnesium salts may also be added to the milk source.

[0030] The milk source may be UHT-treated, pasteurised or non-pasteurised. It may be selected from milk (full fat, skimmed or semi-skimmed), fresh milk, recombined milk, cream, buttermilk, whey, milk containing vegetable fat etc. and any mixtures thereof. Any type of milk can be used, such as cow, sheep, goat or buffalo milk or any mixtures thereof.

[0031] If the milk source is non-pasteurised, the milk source and amino acid mixture may be pasteurised or ultra-high temperature treated or sterilised under typical conditions in the range of 70°C to 150°C over 2s to 20 min, e.g. 125°C for 20 s. Alternatively, the milk source may be heat-treated first prior to amino acid addition, or prior to treatment with a protease and/or peptidase.

[0032] Optionally, L-rhamnose may be added to the milk source.

[0033] To the milk source is then added, in a second step, at least one micro-organism, wherein the micro-organism is selected for producing at least one enzyme capable of modifying the amino acid.

[0034] In the present method, the micro-organism is selected in particular for its ability to produce an enzyme, the action of which, depending on the substrates, produces direct or indirect conversion products which are responsible for a particular flavour.

[0035] Such enzymes are typically transamidase, decarboxylase, dehydrogenase enzymes. Other enzymes such as aldolase may also be produced. Optionally, additives such as protease and/or peptidase may be added together with the micro-organisms.

[0036] The micro-organisms used in the present method may be selected from the group consisting of Beta
coccus, Lactobacillus, Propionibacteria, Streptococcus, Bifidobacterium, Penicillium, Brevibacterium, Arthro
coccus, Corynebacterium, Saccharomyces, Debaryo
coccus, Lactococcus, and any mixtures thereof and/or mix
tures of different strains of the same micro-organism. Preferably, it is a Lactococcus lactis and more preferably it is a Lactococcus lactis including subspecies. Most pref
erably, it is a Lactococcus lactis subsp. lactis and/or Lactococcus lactis subsp. lactis biovar: diacetylactis. It may be added in the form of a living microbial starter culture or in the form of a microbial culture after cell lysis or a mixture of both.

[0037] Strains of Lactococcus lactis which are commercially available and which are suitable for use in the present invention are for example Lactococcus lactis ATCC 29146, Lactococcus lactis subsp. lactis DSM 4366, or still mesophilic aromatic culture (mix), type LD, F-DVS XT-313-eXact, Chr. Hansen.

[0038] Under fermentation conditions, the micro-organism produces at least some enzymes capable of converting the amino acid into further components. Said micro-organisms are capable of producing enzymes such as transamidase and/or decarboxylase and/or dehydrogenase enzymes, which will act on the amino acid(s) present in the fermentation broth. Aldolase may also be produced by the micro-organism.

[0039] Thus, the micro-organism is supplemented with enzymes or enzyme mixes which act on the amino acid to produce the desired flavour character. Furthermore, cell lysates can also additionally be used to modify the amino acid.

[0040] Additional enzymes lipase and lactase are added to the fermentation broth at the start of the fermentation or at a later stage. These may be added in the form of enzyme preparations or micro-organisms which produce said enzymes. Thus, a lipase and lactase are added prior to and/or during and/or after fermentation. This is advantageous for further modulation of the flavour obtained.

[0041] The mix is then fermented. Under fermentation conditions, the released enzymes will react with the amino acid(s) present in the fermentation mixture to produce direct or indirect conversion products which are responsible for particular aromas. These are, for instance, from the group of 3-methyl-butanal, 2-methyl-butanal, 2-m ethyl-1-propanal, 2-phenylacetdehyde, 2,3-butanione (diacetyl), 3-hydroxy-2-butanone (acetoin), 2-phenyl-2 butenal and other phenyl-aldehydes (C10-16), benza
In this context, figures 3 and 4 depict reaction pathways which may lead to some compounds responsible for honey flavour, for cocoa and malt flavour, or for cocoa/coffee flavour respectively. It is clear to the skilled person that figures 3 and 4 are not illustrative of all the reactions occurring when carrying out the methods of the invention. It is also clear that other reactions may occur during fermentation and that other compounds may be produced which provide further modulation of the flavours.

In order to modulate the flavour of the fermentation broth, the amino acid used may be chosen accordingly.

For instance, it has been found that when the amino acid selected is phenylalanine, the direct or indirect conversion products when subjected to a transamidase and/or decarboxylase and/or dehydrogenase enzyme are responsible for a honey-like flavour.

When the amino acid is selected from L-leucine, L-isoleucine, L-valine or mixtures thereof, the particular flavours obtained are those of malt and cocoa.

When rhamnose is optionally used in the starting milk basis, and the mixture before or after fermentation is heated for about 90 minutes at about 90°C, the resulting aroma is that of caramel.

Thus flavours such as honey, caramel, cocoa, malt, cream-caramel, sweet-honey cream, cocoa-caramel, coffee, cream, butter, vanilla, nutty, chocolate etc. and any combination or sub-combination thereof may also be obtained by the method of the invention. Furthermore, the tastes obtained by the method of the invention may be creamy, mouth-coating, long-lasting tastes.

Typically, the fermentation is allowed to take place for about between 2 and 24 hours, preferably between 3 and 12 hours, more preferably about 6 hours at a temperature between 8 and 50°C. Preferably, the fermentation is carried out for about 6 hours at about 30°C.

After a period of time sufficient to produce the desired compounds, the fermentation broth may be cooled to produce a liquid flavour concentrate. A liquid flavour concentrate obtainable by the steps described above is part of the present invention. Alternatively, it may be dried, preferably spray-dried, in order to produce a milk powder-like product having a modulated flavour profile.

After fermentation, the fermentation broth may optionally be neutralised and/or inactivated and/or homogenised by methods known in the art.

Optionally, if the milk source contains L-rhamnose, it may be heated. This heating step differs from the pasteurisation step and the inactivation step in that it is typically carried out for about 90 minutes at about 90°C, in order to develop a caramel-like flavour in the mixture. Without wishing to be bound by theory, it is thought that the sugar sources in the milk basis (lactose, rhamnose etc.) undergo a number of reactions (Maillard reaction pathway) which are responsible for the caramel-like flavour. This heating step may be carried out before or after fermentation.

The fermented mixture is enzymatically treated with lipase and lactase in the form of enzyme preparations or in the form of immobilized enzymes, prior to and/or during and/or after fermentation.

This may be carried out in order to facilitate the drying step and/or to further modulate the taste and flavour of the final product.

For instance, further enzymatic treatment may provide a vanilla-like, cream-like flavour which imparts a creamy, mouth-coating, long-lasting taste to the final product.

Furthermore, the enzymatic treatment may further improve drying properties of the fermented mixture.

Alternatively also, the fermentation broth may be blended with further ingredients. This may be done prior to drying or prior to cool storage for liquid applications, in order to provide, upon drying or not, a finished product.

As another alternative, a milk source treated in a parallel stream may be added to the fermented broth.

The fermented mixture may then be cooled and the liquid product may be stored at low temperature for further use. Such temperatures are typically between 0 and 10°C. The fermented product may then be used as disclosed as a liquid flavour concentrate in the manufacture of food products.

Alternatively, the fermented mixture is then dried, preferably by spray-drying, to give a milk powder-like product. By milk powder-like products is meant products which have the same appearance as and consistency of milk powder, are based on milk, but are produced in a different way. Thus, disclosed are milk powder-like products.

Disclosed is, a milk powder-like product comprising per kg of product 1-20000mg, preferably 10-5000mg butanoic acid, 10-10000mg, preferably 100-3000mg hexanoic acid, 10-6000mg, preferably 100-3000mg octanoic acid, 2-13000mg, preferably 50-10000mg decanoic acid.

Disclosed is that the milk powder-like product further comprises per kg of product 0.1-10mg, preferably 0.1-3mg, more preferably 0.3-1mg of 3-methyl-butanal, 0.1-100mg, preferably 0.1-5mg, more preferably 0.5-2.5mg of 2-phenylacetalddehyde, 0.1-1000mg, preferably 0.1-10 mg, more preferably 1-5mg of diacetyl, 0.5-1000mg, preferably 0.5-20mg, more preferably 1-10mg of acetoin, 1-300mg, preferably 1-100mg, more preferably 10-70mg of 2,3,5,6-tetramethyl pyrazine, 2,3,5,6-tetramethyl pyrazine, 2,4,5-trimethyl oxazole, delta-octalactone (5-octanolide), delta-decalactone (5-decanolide), delta-dodecalactone (5-dodecanolide), butanoic acid, hexanoic acid, octanoic acid, decanoic acid, dodecanoic acid, 4-hydroxy-2,5-dimethyl-3(2H)-furanone (furan aldehyde, 5-decalactone (5-methyl-2-phenyl-cis-2-hexenal (cocal),...
Disclosed is that the milk powder-like product further comprises per kg of product 0.1-1000mg, preferably 0.1-50mg, more preferably 1-3mg of diacetyl, 0.5-1000mg, preferably 0.5-50mg, more preferably 1-20mg of acetoin, 1-300mg, preferably 1-100mg, more preferably 15-80mg of 2,3,5,6-tetramethyl pyrazine, 0.01-50mg, preferably 0.01-20mg, more preferably 0.01-15mg of 2,4,5-trimethyl oxazole, 0.1-10mg, preferably 0.5-8mg of benzaldehyde. Preferably, the powder comprises 50-300mg of butanoic acid, 500-2000mg of hexanoic acid, 400-2500mg of octanoic acid and 100-700mg of decanoic acid per kg of product. Such milk powder-like product has a particular cream-butter flavour.

Disclosed is that the milk powder-like product further comprises per kg of product 0.1-100mg, preferably 0.1-10mg, more preferably 0.5-5mg of 3-methyl-butanal, 0.05-100mg, preferably 0.05-10mg, more preferably 0.1-5mg of 2-methyl-butanal, 0.05-20mg, preferably 0.1-2mg, more preferably 0.1-1mg of 2-methyl-propanal, 0.1-500mg, preferably 0.1-10mg, more preferably 1-8mg of diacetyl, 0.5-500mg, preferably 0.5-20mg, more preferably 1-10mg acetoin, 1-500mg, preferably 1-50mg, 1-300mg of 2,3,5,6-tetramethyl pyrazine, 0.01-20mg, preferably 0.01-15mg of 2,4,5-trimethyl oxazole, 0.05-10mg, preferably 0.1-8.5mg of benzaldehyde. Preferably, the powder comprises 50-350mg of butanoic acid, 400-2000mg of hexanoic acid, 400-2000mg of octanoic acid and 100-800mg of decanoic acid per kg of product. Such milk powder-like product has a particular cocoa-cream and malt-cream flavour. In an even more preferred embodiment, the milk powder-like product disclosed may have a strong flavour or a more subtle flavour.

In a preferred embodiment, the taste and flavour modulated milk powder-like products are added in relatively small amounts to food products, for example 0.05 - 10 wt% for liquid, solid or powder products.

In a particular embodiment of the present invention, the fermented milk source is added to a milk powder or a milk powder precursor. The fermented milk source may be in liquid concentrate or powder form. Thus, the fermented milk source may be added in the powder form to a milk powder and thus provide a flavoured milk powder. Depending on the amount added, the resulting product as disclosed may have a strong flavour or a more subtle flavour.

Alternatively, the fermented milk source may be added to a milk powder precursor and further spray-dried to yield the flavoured milk powder. By “milk powder precursor” is to be understood a standard liquid milk composition prior to spray-drying. The resulting products as disclosed may thus be provided with a subtle, subliminal, distinct flavour perception.

In another embodiment of the present invention, the fermented milk source is added to a frozen dessert mix. The fermented milk source may again be in the form of a liquid concentrate or a powder. It may be added to the frozen dessert mix at any stage of manufacture of the frozen dessert. This results in a frozen dessert, preferably an ice cream, having a subtle natural flavour.

The present methods offer the advantage that it allows a lot of variation as to the components present in the fermented milk source which can further be used for addition in a wide variety of food products. It combines...
aspects of the food ripening methods known in the art, and adapts it to a new field, notably that of natural flavour powders or natural flavour liquid concentrate. The powders or liquid concentrates thus obtainable as disclosed may be used in any food application, such as milk drinks, ice cream, chocolate, soups, dairy product, culinary product, infant formulae, health care products etc.

0076 The method further allows to "tailor" the flavours obtained upon fermentation, such that a modulation in the taste of the milk powder-like product, the liquid concentrate or the final food product is possible.

0077 Thus, the present invention provides many options for the variation and modulation of milk powder-like product as disclosed, whereby variation can be obtained by any combination of amino acid and/or processing conditions as described above. The variety of flavours obtainable by the method of the present invention lends itself thus to a wider range of applications.

0078 Referring to Figure 1 which represents an embodiment of the method of the present invention, it can be seen that various flavours, in such cases sweet honey, sweet honey and cream butter, malt and chocolate, and milk, chocolate and honey flavours may be obtained. The parameters which may be altered in each case may be the amino acids, the micro-organism(s) and/or the amount thereof, for instance more than one source, the order of processing etc.

0079 The milk powders or other food products obtainable by methods of the present invention, present the advantage that they are free of additives and the resulting products are thus "clean label" products. This is in contrast to traditional milk-based powders which require the addition of artificial flavouring in order to modulate their aroma.

0080 Furthermore, the flavours are derived from biological processes, e.g. enzymatic, microbial, and are therefore naturally generated flavour compounds, or "bi-oflavours".

0081 It is also within the present invention to modify certain components, or mixtures of components when carrying out the processes of the invention in order to obtain perceptible organoleptic differences in the final powders or liquid concentrates. Any combination of taste and flavour modulated milk powder or liquid concentrates by blending or process combinations are included in this application.

0082 For instance, using a mixture of the amino acids phenylalanine, leucine, isoleucine and valine, a chocolate, malt and honey flavour may be obtained. Also, it is conceivable that by adding a source of rhamnose and phenylalanine to the milk source, and heating the mixture before or after fermentation prior to drying would yield a honey-caramel flavour.

0083 Optionally, flavour compounds can be principally added as complementing additives to the fermented milk source. However, this is not necessary since the present invention provides a wide range of flavourings which are completely natural.

0084 The present invention is further illustrated hereinafter by means of non-limiting examples.

Examples

Example 1: sweet honey-cream flavoured milk powder-like product

0085 100kg full cream milk powder is recombined with water to a final concentration of 35% dry matter. 0.1kg of L-phenylalanine is added, the pH value adjusted to 6.7 with potassium hydroxide solution and the mix preheated at 80°C and UHT treated at 125°C for 20s. After cooling to 30°C, 3kg of Lactococcus lactis starter and 0.07kg commercial lipase enzyme preparation is added to start the fermentation. After 10 hours at 30°C, the pH is adjusted to 6.7 with potassium hydroxide solution and 0.9kg commercial lactase enzyme preparation is added and incubated for 3 hours. After cooling to 15°C for intermediate storage, the mixture is heat treated at 80°C for 80s, homogenized and spray dried.

Example 2: cocoa-cream flavoured milk powder-like product (not according to the invention)

0086 100kg full cream milk powder is recombined with water to a final concentration of 35% dry matter. 0.1kg of L-phenylalanine, 0.1kg alpha-ketoglutaric acid, 0.1kg L-leucine, 0.1kg L-isoleucine, 0.1kg L-valine is added, the pH value adjusted to 6.7 with potassium hydroxide solution and the mix preheated at 80°C and UHT treated at 125°C for 20s. After cooling to 30°C, 3kg of a mixture of strains of Lactococcus lactis starter and 0.03kg commercial lipase enzyme preparation is added to start the fermentation. After 12 hours at 30°C, the pH is adjusted to 6.7 with potassium hydroxide solution. After cooling to 15°C for intermediate storage, the mixture is heat treated at 80°C for 80s, homogenized and spray dried.

Example 3: analysis of flavour compounds

0087 1.80g NaCl is weighted into a 20ml crimp top vial and a magnetic stirring bar is added. 5.50 g of sample solution containing 12% dry matter is added. 50 μl of internal standard ethylvalerate solution (45 μl ethylvalerate in 100ml water) and 50 μl of internal standard 4-methylcyclopentane acid solution (75 μl of methylcyclopentane acid in 250ml water) is added, followed by closing of the vial. The vial is then placed into a water bath at 65°C using a magnetic hot plate stirrer with contact thermometer at a speed range of about 870 rpm. After an equilibration time of 30min the fibre assembly (SPME Fibre Assembly, 2cm, 50/30μm DVB/ CAR/PDMS StableFlex mounted in holder, both manufactured by SUPELCO Bellefonte, USA) is inserted by piercing the septa (depth gauge at 20mm) and by exposure the fibre completely to the headspace above the sample solution. After a sorption time...
of 30min the fibre is retracted and removed into the fibre assembly and out of the vial.
The fibre assembly is immediate injected into the GC injector (depth gauge at 30mm) and the separation is started by exposure of the fibre at the same time. After 5min the fibre is retracted and removed from the injector.

[0088] The flavour compounds are separated by gas chromatography on a FFAP capillary column (50m, 0.2mm inner diameter, 0.3 µm coating, Agilent Technologies USA) using helium as carrier gas and a temperature gradient from 40°C to 250°C. The separated compounds are detected and identified by mass spectrometry. Relative quantification is done by calculation of the response of flavour compounds in relation to the known amounts of the internal standards ethylvalerate (neutral compounds) and 4-methyloctanoic acid (acidic compounds).

Example 4

[0089] To 98kg of ice cream mix, 3kg of liquid fermented mix or 1kg of fermented milk powder is added. The final ice cream mix is then pasteurized at 80°C for 80s, followed by homogenisation, cooling to 3°C, ice cream aging, freezing and packaging.

Claims

1. Method to promote a non-savoury flavour in a food product, comprising the steps of:

   a) adding at least one amino acid to a milk source, wherein the amino acid is selected from phenylalanine, leucine, isoleucine, valine and mixtures thereof,
   b) adding at least one micro-organism to the milk source, wherein the micro-organism produces at least one enzyme capable of converting the amino acid(s),
   c) fermenting the milk source, wherein the released enzyme(s) react(s) with the amino acid(s) present in the fermentation mixture to provide direct or indirect conversion products which are responsible for a particular flavour, wherein the flavour is a non-savoury flavour,
   d) adding a lipase and lactase in the form of enzyme preparations or in the form of immobilized enzymes, prior to and/or during and/or after fermentation,
   e) optionally drying the fermented milk source and
   f) adding said fermented milk source to the food product.

2. Method according to claim 1 wherein the food product is a frozen dessert.

3. Method according to claim 2, wherein the frozen dessert is ice cream.

4. Method according to any of the preceding claims, wherein between 0.05 and 2 weight % of the amino acid is added to the milk source.

5. Method according to any of the preceding claims, wherein the milk source is selected from full fat milk, skimmed milk, semi-skimmed milk, fresh milk, recombined milk, cream, buttermilk, whey, milk containing vegetable fat and any mixtures thereof.

6. Method according to any of the preceding claims, wherein an alpha-keto acid selected from alpha-keto glutarate, alpha-ketoisocaproate, alpha-ketoisovalerate, similar amino acceptors or mixtures thereof is added to the milk source.

7. Method according to any of the preceding claims, wherein a pasteurisation step is carried out prior to addition of the micro-organism.

8. Method according to any of the preceding claims, wherein the micro-organism produces at least the enzymes transamidase and/or decarboxylase and/or dehydrogenase.

9. Method according to claim 8, wherein the micro-organism produces the enzyme aldolase.

10. Method according to any of the preceding claims, wherein the micro-organism is selected from Beta-coccus, Lactobacillus, Propionibacteria, Streptococcus, Bifidobacterium, Penicillium, Brevibacterium, Arthrobacter, Corynebacterium, Saccharomyces, Debaromyces, Lactococcus and any mixtures thereof and/or mixtures of different strains of the same micro-organism.

11. Method according to claim 10, wherein the micro-organism is a Lactococcus lactis.

12. Method according to any of the preceding claims, wherein L-rhamnose is added to the milk source.

13. Method according to claim 12, wherein a heating step is carried out before or after fermentation.

14. Method according to any of the preceding claims, the method comprising the step of neutralising and/or inactivating and/or homogenising the fermented milk source prior to drying and/or prior to addition to the food product.

15. Method according to any of the preceding claims, wherein the drying step is carried out by spray-drying.
16. Method according to any of the preceding claims, wherein the flavour is honey, caramel, cocoa, malt, cream-caramel, sweet-honey cream, cocoa-cream, coffee, cream, butter, vanilla, nutty, chocolate and any combination or sub-combination thereof.

17. Method according to any of the preceding claims, wherein the fermented milk source is in the form of a liquid concentrate or a powder.

18. Method according to any of the preceding claims, wherein the fermented milk source is added to the food product or frozen dessert mix in an amount of 0.05-10% by weight on a dry matter basis.

19. The method according to claim 18, wherein the food product is ice cream, chocolate-based product, dairy product, creamer, cocoa beverage, culinary product, infant formula or health care product.

20. Verfahren zur Förderung eines nicht herzhaften Geschmacks in einem Lebensmittelprodukt, umfassend die folgenden Schritte:

a) Hinzufügen wenigstens einer Aminosäure einer Milchquelle, wobei die Aminosäure ausgewählt ist aus Phenylalanin, Leucin, Isoleucin, Valin und Mischungen davon.

b) Hinzufügen wenigstens eines Mikroorganismus der Milchquelle, wobei der Mikroorganismus wenigstens ein Enzym erzeugt, das die Aminosäure(n) umwandeln kann.

c) Fermentieren der Milchquelle, wobei das freigesetzte Enzym/die freigesetzten Enzyme mit der Aminosäure/den Aminosäuren, die in der Fermentationsmischung vorliegen, reagiert/reagieren, um direkte oder indirekte Umwandlungsprodukte zur Verfügung zu stellen, die für einen bestimmten Geschmack verantwortlich sind, wobei der Geschmack ein nicht herzhafter Geschmack ist.

d) Hinzufügen einer Lipase und Lactase in Form von Enzympräparaten oder in Form von immobilisierten Enzymen vor und/oder während und/oder nach der Fermentation,

e) optionales Trocknen der fermentierten Milchquelle und

f) Hinzufügen der fermentierten Milchquelle zum Lebensmittelprodukt.

2. Verfahren nach Anspruch 1, wobei das Lebensmittelprodukt ein gefrorenes Dessert ist.

3. Verfahren nach Anspruch 2, wobei das gefrorene Dessert Speiseeis ist.
che, wobei der Trocknungsschritt durch Sprührocknung durchgeführt wird.


17. Verfahren nach einem der vorangehenden Ansprüche, wobei die fermentierte Milchquelle in der Form eines flüssigen Konzentrats oder eines Pulvers vorliegt.

18. Verfahren nach einem der vorangehenden Ansprüche, wobei die fermentierte Milchquelle dem Lebensmittelprodukt oder der gefrorenen Dessertmischung in einer Menge von 0,05-10 Gew.-% beigemengen werden kann.

19. Verfahren nach Anspruch 18, wobei das Lebensmittelprodukt Speiseeis, ein auf Schokolade basierendes Produkt, ein Milchprodukt, eine Kaffeesahne, ein Kakaogetränk, ein kulinarisches Produkt, eine Säuglingsnahrung oder ein Gesundheitsprodukt ist.

Revendications

1. Procédé pour promouvoir un goût non salé dans un produit alimentaire, comprenant les étapes consistant à :

   a) ajouter au moins un acide aminé à une source laitière, où l’acide aminé est choisi parmi la phénylalanine, la leucine, l’isoleucine, la valine et leurs mélanges,
   b) ajouter au moins un micro-organisme à la source laitière, où le micro-organisme produit au moins une enzyme capable de convertir le ou les acide(s) aminé(s),
   c) fermenter la source laitière, où la ou les enzyme(s) libérée(s) réagit(s)en avec le ou les acide(s) aminé(s) présent(s) dans le mélange de fermentation pour fournir des produits de conversion directe ou indirecte qui sont responsables d’un goût particulier, où le goût est un goût non salé,
   d) ajouter une lipase et une lactase sous la forme de préparations enzymatiques ou sous la forme d’enzymes immobilisées, avant et/ou pendant et/ou après la fermentation,
   e) éventuellement sécher la source laitière fermentée et
   f) ajouter ladite source laitière fermentée au produit alimentaire.

2. Procédé selon la revendication 1, dans lequel le produit alimentaire est un dessert congelé.

3. Procédé selon la revendication 2, dans lequel le dessert congelé est une crème glacée.

4. Procédé selon l’une ou l’autre des revendications précédentes, dans lequel on ajoute entre 0,05 et 2 % en poids de l’acide aminé à la source laitière.

5. Procédé selon l’une ou l’autre des revendications précédentes, dans lequel la source laitière est choisie parmi le lait entier, le lait écrémé, le lait demi-écrémé, le lait frais, le lait recombined, la crème, le beurre, le lactosérum, du lait contenant de la graisse végétale et n’importe lesquels de leurs mélanges.


9. Procédé selon la revendication 8, dans lequel le micro-organisme produit l’enzyme aldolase.


11. Procédé selon la revendication 10, dans lequel le micro-organisme est un Lactococcus lactis.


13. Procédé selon la revendication 12, dans lequel une étape de chauffage est effectuée avant ou après fermentation.

précédentes, le procédé comprenant l’étape consis-
tant à neutraliser et/ou à inactiver et/ou à homogé-
énéiser la source laitière fermentée avant séchage
et/ou avant ajout au produit alimentaire.

15. Procédé selon l’une quelconque des revendications
précédentes, dans lequel l’étape de séchage est ef-
fectuée par séchage par pulvérisation.

16. Procédé selon l’une quelconque des revendications
précédentes, dans lequel le goût est miel, caramel,
cacao, malt, crème-caramel, crème au miel sucré,
cacao-crème, café, crème, beurre, vanille, noix, cho-
colat et n’importe quelle combinaison ou sous-com-
binaison de ceux-ci.

17. Procédé selon l’une quelconque des revendications
précédentes, dans lequel la source laitière fermente-
tée est sous la forme d’un concentré liquide ou d’une
poudre.

18. Procédé selon l’une quelconque des revendications
précédentes, dans lequel la source laitière fermente-
tée est ajoutée au produit alimentaire ou au mélange
pour dessert congelé en une quantité de 0,05 à 10
% en poids sur une base de matière sèche.

19. Procédé selon la revendication 18, dans lequel le
produit alimentaire est de la crème glacée, un produit
to base de chocolat, un produit laitier, un succédané
de crème, une boisson au cacao, un produit culinaire,
e une préparation pour nourrissons ou un produit
de soins de santé.
Figures

1. Milk source 35% TS
   Pasteurisation
   Fermentation with micro-organisms, amino acids and/or protease, lactase, lipase for 6 h / 30°C
   Neutralisation, Inactivation & Homogenisation
   Spray-drying

   Figure 1

2. Milk source 35% TS and amino acids and alpha-ketoglutarate
   Pasteurisation
   Fermentation with micro-organisms 6 h / 30°C
   Neutralisation, Inactivation & Homogenisation
   Spray-drying

   Figure 2
Figure 3

Figure 4
Phenyl acetaldehyde
Honey TV: 4 ppb (water)

3-Methylbutanal

Aldolase

CH₃
CH₂CH₂CH=C=C-H

Coca, 5-methyl-2-phenyl-2Z-hexenal (cocoa-coffee)

Figure 5

Milk source 40 % TS

Pasteurisation

Fermentation with micro-organisms, amino acids and/or protease, lactase, lipase for 6 h / 30°C

Neutralisation, Inactivation & Homogenisation

Cool storage for addition to final products

Figure 6
REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader’s convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- CA 1220075 [0003] [0009]
- EP 1186244 A [0003] [0006]
- US 3858492 A [0003] [0013]
- DE 2362998 [0007]
- WO 0200845 A [0008]
- US 4675193 A [0009]
- DE 148419 [0012]

Non-patent literature cited in the description