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QUARK BASE COMPOSITION WITH ENHANCED TASTE PROPERTIES II

Field of the invention

The invention is in the field of dairy products and concerns a quark with enhanced taste and a process for its manufacture.

State of the art

Quark is usually produced by subjecting skimmed milk to a temperature treatment and denaturing the proteins it contains.

The subsequent addition of lactic acid bacteria and rennet causes the milk to coagulate (phase inversion). The casein coagulates and forms the technically designated jelly. After maturing (8 to 20 hours), the jelly is stirred. This triggers whey separation and the two phases are then separated in the separator. The liquid sour whey is processed elsewhere, and the quark base composition is adjusted to the desired fat and protein content by adding cream.

However, these state-of-the-art methods have the disadvantage that the sensory evaluation of the quark is judged unsatisfactory by many consumers. Either the product is flawless in taste, but has a rough structure, or the haptic impression is creamy, but leaves a slimy overall impression.

There is also a strong market demand for ready-to-eat quark preparations with a fresh fruit topping, whether in the form of a puree or a salad with chunky fruits. Until now, such products had to be freshly prepared before consumption. The problem here is not so much keeping the fruit-containing quark preparations fresh and preserving them in the packaged state. More essentially problematic is the fact that the fruits draw water and the fruit juice pulls through the product, adding water to it and thus negatively influencing the consumption properties.

US 2005/208630 A1, DE 601 29 217 T2, EP 1 752 046 A1 and DE 23 23 107 A1 describe quark base compositions produced using starter culture mixtures.

The complex task of this invention was therefore to provide a quark base mix with taste-enhancing properties that, when consumed, leaves a creamy impression without the product having a slimy taste. Furthermore, the quark base mix should have such a consistency that it can be mixed with a fresh fruit preparation without the fruit juice diluting the quark base mix.

Description of the invention

The invention is defined by the annexed claims.

A first object of the invention concerns a quark base composition with improved taste properties, obtainable by

(a) subjecting raw milk to a temperature treatment and separating off the cream to form a non-acidified quark base mix;

(b) subjecting the resulting mixture to a temperature treatment until denaturation occurs;

(c) mixing the denatured product with starter cultures and rennet and, where appropriate

(d) adjusting the quark base mix obtained after fermentation to a defined dry mass and protein content,

and the following are used as starter cultures in the proportions as defined in Claim 1:

(i) a first mixture of five microorganisms comprising (i-1) *Streptococcus thermophilus*, (i-2) *Leuconostoc species*, (i-3) *Lactococcus lactis subsp. lactis biovar diacetylactis*, (i-4) *Lactococcus lactis subsp. lactis* and (i-5) *Lactococcus lactis subsp. cremoris*, and

(ii) a second mixture of three microorganisms comprising (ii-1) *Streptococcus thermophilus*, (ii-2) *Lactococcus lactis subsp. lactis* and (ii-3) *Lactococcus lactis subsp. cremoris*

Preferably, the quark base mix according to the invention has a Brookfield viscosity at 20°C (RVT, spindle 1, 10 rpm) in the range of about 1,000 to about 8,000 mPas, preferably about 2,000 to about 6,00 mPas and in particular about 3,000 to about 5,000 mPas.

A second object of the invention concerns a ready-to-eat quark preparation containing the basic mix described above and a layer of a fresh fruit preparation. This fruit preparation can be, for example, a fruit puree or fruit salad. Alternatively, crushed nuts, pieces of chocolate or sauces can also be used as so-called toppings.

A third object of the invention is a process for the production of a quark base mix with improved taste properties in which

(a) raw milk is subjected to a temperature treatment and the cream is separated out to form a non-acidified quark base mix;

(b) the mixture thus obtained is subjected to a temperature treatment until denaturation occurs,

(c) the denatured product is admixed with starter cultures and rennet and, where appropriate

(d) the quark base mix obtained after fermentation is adjusted to a defined dry mass and protein content,

wherein the following are used as starter cultures:

(i) a first mixture of five microorganisms comprising (i-1) *Streptococcus thermophilus*, (i-2) *Leuconostoc species*, (i-3) *Lactococcus lactis subsp. lactis biovar diacetylactis*, (i-4) *Lactococcus lactis subsp. lactis* and (i-5) *Lactococcus lactis subsp. cremoris*, and

(ii) a second mixture of three microorganisms comprising (ii-1) *Streptococcus thermophilus*, (ii-2) *Lactococcus lactis subsp. lactis* and (ii-3) *Lactococcus lactis subsp. cremoris*

in the proportions as defined in Claim 5.

Surprisingly, it was discovered that by using the selected starter cultures as defined in the independent claims, a significantly improved taste of quark is obtained, which tastes creamy and does not leave a slimy overall impression. By using a special rotor-stator technology during the mixing or post-treatment of the products, the creaminess can be significantly improved once again. In addition, this measure produces a consistency that does not completely prevent the penetration of fruit juice from a fruit layer, but delays it considerably. In this way, ready-to-eat quark preparations with a fresh fruit topping can now be produced on an industrial scale for the first time. In this way, the quark base mix, the ready-to-eat quark preparation and the associated manufacturing process are linked by a common inventive idea.

Preparation of the non-acidified quark base mix

To produce the non-acidified quark base mix, solids are first separated out and the fat content of about 4 % by weight is skimmed off from the raw milk. This usually takes place in a special component, preferably a separator. Such components are well known from the state of the art. Separators from GEA Westfalia Separator GmbH, with which the two steps can be carried out

individually or together, are very common in the dairy industry.[1] Corresponding components are also described, for example, in **DE 10036085 C1** (Westfalia) and are well known to the person skilled in the art, such that no explanation is required for carrying out these process steps, as they are part of the general specialist knowledge.

[1](http://www.westfalia-separator.com/de/anwendungen/molkereitechnik/milch-molke.html)

The heat treatment of raw milk is preferably carried out in heat exchangers and plate heat exchangers have proven to be particularly suitable. The heat exchangers are provided with a temperature gradient selected so that the raw milk is heated to a temperature of approximately 70 to 80 °C, and in particular 72 to 74 °C, for a minimum residence time of 20 seconds and a maximum residence time of 60 seconds, preferably approximately 30 seconds.

Denaturation

In the next step, the non-acidified quark base mix thus obtained is subjected to a thermal treatment. The denaturation can now take place in a manner known per se, namely over a period of about 5 to about 10 minutes and preferably about 6 minutes and at temperatures of about 85 to about 90 °C and in particular about 88 °C.

Fermentation and standardisation

The fermentation of the denatured primary product can also be carried out according to the known state of the art processes. Suitable starter cultures and rennet are added for this purpose.

The starter cultures contain:

- 25 to 75% by weight and preferably 40 to 60% by weight of the first mixture (i) and
- 75 to 25% by weight, and preferably 60 to 40% by weight of the second mixture (ii)

with the proviso that the amounts add up to 100% by weight, and wherein the mixture (i) contains the five microorganisms in each case in quantities of 20 ± 5% by weight and the mixture (ii) contains the three microorganisms in each case in quantities of 33 ± 5% by weight.

Particularly preferred are starter cultures which contain:

- 40 to 60% by weight of mixture (i), and
- 60 to 40% by weight of mixture (ii)

with the above specifications.

Instead of using the two commercially available preparations (i) and (ii) together, it is naturally also possible in principle to use the five micro-organisms individually and then mix them in such a way as to obtain a starter culture mixture as defined above and in the claims with which to obtain the taste-enhanced quark products.

Such starter cultures then preferably contain

- about 20 to about 30% by weight of *Streptococcus thermophilus*;
- about 5 to about 15% by weight of *Leuconostoc species*;
- about 5 to about 10% by weight of *Lactococcus lactis subsp. lactis biovar diacetylactis*;
- about 20 to about 30% by weight of *Lactococcus lactis subsp. lactis*;
- about 20 to about 30% by weight of *Lactococcus lactis subsp. cremoris*, and

with the proviso that the amounts add up to 100% by weight.

Particularly preferred are starter cultures containing

- 25% by weight of *Streptococcus thermophilus*;
- 12% by weight of *Leuconostoc species*,
- 13% by weight of *Lactococcus lactis subsp. lactis biovar diacetylactis*;
- 25% by weight of *Lactococcus lactis subsp. lactis*;
- 25% by weight of *Lactococcus lactis subsp. cremoris*

AII the indicated microorganisms are freely available in the market.

The temperature at which fermentation occurs depends on the optimum temperature range for the respective micro-organisms used, typically between 18 and 35 °C, preferably around 30 °C.

The fermented milk products can sometimes exhibit quality fluctuations due to different influences in the production process. Triggers such as temperature fluctuations, changes in pH-values, mechanical shocks and the like are usually unavoidable. The result is a rough structure ("specks"), syneresis, viscosity fluctuations and the like. To avoid this, shear energy is introduced into the fermented mix in another preferred embodiment of the invention.

This can be done, for example, by smooth stirring in the tank, which sometimes leads to a decrease in viscosity and is therefore not particularly preferred. Frequently, air is also introduced in the process, which leads to oxidation processes and a bad taste.

Alternatively, so-called smoothing valves can also be used. Although this reduces the roughness in the product, it can also lead to a reduction in viscosity and, especially towards the end of the process, there is also a risk of specks slipping through as a result of pressure fluctuations, which can then be found in the end product. In a further embodiment, sieves can also be used, but this is often at the expense of creaminess. In addition, sieves are difficult to keep clean.

In the context of this invention, it has therefore proved particularly advantageous to further improve the creaminess of the product by introducing a defined amount of heavy energy via at least one rotor-stator mixer; this process is also referred to as stretching. Depending on requirements, one- to three-stage systems are used. The desired viscosity and creaminess can be set by varying the slot width, number and geometry of the rows of teeth, number of rotor-stator sets, residence time and rotational speed, wherein the adjustment of these parameters can be carried out by an expert on the basis of their general knowledge without having to be inventive. Corresponding components are, for example, commercially available under the designation "Ytron-Z" (Ytron mixer) from Ytron Process Technology GmbH.

The quark base mix obtained after fermentation and possibly stretching is then adjusted to the desired dry mass and protein content by adding cream, for example. Preferably the dry matter content is about 15 to about 20% by weight and especially about 18% by weight. The protein content can be about 10 to about 15% by weight and preferably about 12% by weight.

Samples

Samples 1 to 4, comparison samples V1 to V5

4 kg of skimmed milk was treated for 6 min at 88 °C and the proteins contained were denatured. The mix was admixed with various lactic acid bacteria and rennet, matured at 30 °C for about 18

hours and then stirred. The fermentation product was then placed in a centrifuge and approx. 3.2 kg sour whey was separated out as a liquid component. The remaining quark mix (approx. 800 g) was adjusted to a dry mass of 18% by weight and a protein content of 12% by adding cream. Sample 4 differs from Sample 2 in that the base mix was additionally stirred ("stretched") after fermentation in a YTRON rotor-stator mixer. The taste and sensory properties of the products were then evaluated by a panel consisting of 5 experienced testers on a scale from 1 (= not applicable) to 6 (= fully applicable). The results are summarised in **Table 1**. Samples 1 to 4 are according to the invention and Samples V1 to V5 are for comparison. The mean values of the evaluations are given.

Table 1

Taste and sensory evaluation of the quark base mixes

Samp.	**Starter Culture**	**Taste**	**Sensory properties**		
		Bitter	**Creamy**	**Smooth**	**Slimy**
V1	*Bifidobacterium lactis B12*	5.5	3.0	2.0	5.5
V2	*Lactobacillus acidophilus*	5.0	3.5	2.0	5.5
V3	*Bifidobacterium lactis B12 + Lactobacillus acidophilus (1:1)*	5.0	3.0	2.0	5.5
V4	Mixture (i)	3.0	2.5	2.0	4.0
V5	Mixture (i)	4.0	2.0	2.0	4.0
1	Mixture (i+ii) = 75:25	2.0	4.0	3.5	2.0
2	Mixture (i+ii) = 50:50	1.5	4.5	4.0	1.0
3	Mixture (i+ii) = 25:75	2.5	4.0	3.5	1.5
4	Mixture (i+ii) = 50:50	1.0	5.5	4.5	1.0

The tests and comparative tests clearly show that the selection of starter cultures has a considerable influence on the taste and sensory properties of the quark base mix. The quark base mix with the best properties, i.e. the lowest bitterness, the highest creaminess, which also leaves no slimy impression, was obtained with a combination of culture mixtures (i) and (ii) according to the invention. The sensory values were further improved by treatment in the Ytron mixer.

Samples 5 to 7, comparison samples V6 to V10

The following samples show the influence that the targeted introduction of stirring energy into the

fermented quark base mix has on its physico-chemical behaviour. The effect of the treatment on the tendency of the quark base mix to absorb water when fruit preparations are added and thus to dilute the taste was evaluated. For this purpose, quark base mixes according to the invention, which had been produced on the basis of different starter cultures, were mixed once before and once after treatment with a YTRON rotor-stator mixer (20°C, 15 min, 2,500 rpm), each coated with a 25% by weight of a sweetened chunky fruit preparation made of strawberries and pineapple and both the visual and taste impression after storage of the preparations over a period of 5 hours at 7 °C was evaluated by a panel of 5 experienced testers.

The visual evaluation was based on a scale of (1) = clear separation between quark mix and fruit preparation and (4) = quark mix and fruit preparation mixed; the taste evaluation was analogous undertaken on a scale of (1) = succinct fruit taste to (4) = watery taste.

The results are summarised in **Table 2** below. Samples 5 to 7 are according to the invention and Samples V6 to V10 are for comparison.

Table 2

Evaluation of the quark base mixes without or with after-treatment with a rotor-stator mixer

Samp.	Starter Culture	Visual impression		Taste impression	
		with	without	with	without
V6	*Bifidobacterium lactis B12*	3.5	3.0	3.0	2.5
V7	*Lactobacillus acidophilus*	3.5	3.0	3.0	3.0
V8	*Bifidobacterium lactis B12 + Lactobacillus acidophilus (1:1)*	3.5	3.0	3.0	2.5
V9	Mixture (i)	3.0	3.0	3.0	2.5
V10	Mixture (i)	3.0	2.5	3.0	2.5
5	Mixture (i+ii) = 75:25	2.0	1.0	2.0	1.0
6	Mixture (i+ii) = 50:50	1.5	1.0	1.5	1.0
7	Mixture (i+ii) = 25:75	2.0	1.0	2.0	1.0

The samples and comparative samples show that the after-treatment in the rotor-stator mixer consistently improves both the visual and the taste impression once again. The use of the selected culture mixtures results in a significantly better end product compared to the standard bifidobacterium product.

Patentkrav

1. Kvarkgrundmasse med forbedrede smagsegenskaber, som kan opnås ved, at man

(a) underkaster råmælk en temperaturbehandling og skiller fløden fra, således at der dannes en usyrnet kvarkgrundmasse,

(b) underkaster den således opnåede blanding en temperaturbehandling, indtil denaturering,

(c) sætter starterkulturer og osteløbe til det denaturerede produkt og eventuelt

(d) indstiller den efter afsluttet fermentering opnåede kvarkgrundmasse til et defineret tørstof- og proteinindhold,

og som starterkultur tilsætter

(i) 25 til 75 vægtprocent af en første blanding af fem mikroorganismer omfattende (i-1) *Streptococcus thermophilus,* (i-2) *Leuconostoc species,* (i-3) *Lactococcus lactis subsp. lactis biovar diacetylactis,* (i-4) *Lactococcus lactis subsp. lactis* og (i-5) *Lactococcus lactis subsp. cremoris,* og

(ii) 75 til 25 vægtprocent af en anden blanding af tre mikroorganismer omfattende (ii-1) *Streptococcus thermophilus,* (ii-2) *Lactococcus lactis subsp. lactis* og (ii-3) *Lactococcus lactis subsp. Cremoris*

med det forbehold, at mængderne tilsammen giver 100 vægtprocent, og hvor i blandingen (i) forekommer de fem mikroorganismer hver i mængder af 20 ± 5 vægtprocent, og i blandingen (ii) forekommer de tre mikroorganismer hver i mængder af 33 ± 5 vægtprocent.

2. Kvarkgrundmasse ifølge krav 1, **kendetegnet ved, at** blandingerne af starterkulturer indeholder i vægtforholdet (i):(ii) fra 40:60 til 60:40.

3. Færdigt kvarkpræparat, indeholdende grundmassen ifølge krav 1 og også en aftopning af et frisk frugtpræparat.

4. Præparat ifølge krav 3, **kendetegnet ved, at** frugtpræparatet er en frugtpuré eller frugtsalat.

5. Fremgangsmåde til fremstilling af en kvarkgrundmasse ifølge krav 1, ved hvilken man

(a) underkaster råmælk en temperaturbehandling og skiller fløden fra, således at der dannes en usyrnet kvarkgrundmasse,

(b) underkaster den således opnåede blanding en temperaturbehandling, indtil denaturering,

(c) sætter starterkulturer og osteløbe til det denaturerede produkt og eventuelt

(d) indstiller den efter afsluttet fermentering opnåede kvarkgrundmasse til et defineret tørstof- og proteinindhold,

og som starterkultur tilsætter

(i) 25 til 75 vægtprocent af en første blanding af fem mikroorganismer omfattende (i-1) *Streptococcus thermophilus,* (i-2) *Leuconostoc species,* (i-3) *Lactococcus lactis subsp. lactis biovar diacetylactis,* (i-4) *Lactococcus lactis subsp. lactis* og (i-5) *Lactococcus lactis subsp. cremoris,* og

(ii) 75 til 25 vægtprocent af en anden blanding af tre mikroorganismer omfattende (ii-1) *Streptococcus thermophilus,* (ii-2) *Lactococcus lactis subsp. lactis* og (ii-3) *Lactococcus lactis subsp. Cremoris*

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6. Fremgangsmåde ifølge krav 5, **kendetegnet ved, at** blandingerne af starterkulturer indeholder i vægtforholdet (i):(ii) fra 40:60 til 60:40.

7. Fremgangsmåde ifølge mindst et af kravene 5 til 6, **kendetegnet ved, at** den usyrnede kvarkgrundmasse underkastes en temperaturbehandling ved 85 til 90 °C i et tidsrum fra 5 til 10 min. og derved denatureres.

8. Fremgangsmåde ifølge mindst et af kravene 5 til 7, **kendetegnet ved, at** kulturer og osteløbe sættes til den således opnåede denaturerede masse ved 18 til 35 °C.

9. Fremgangsmåde ifølge mindst et af kravene 5 til 8, **kendetegnet ved, at** kvarkgrundmassen underkastes en efterbehandling, hvor der anvendes forskydningsenergi.

10. Fremgangsmåde ifølge krav 9, **kendetegnet ved, at** forskydningsenergien udføres med mindst en rotor-stator-blander.