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(54) **Method of making cheese.**

(57) Described is a method of making cheese wherein a cheese intermediate is subjected to a high isostatic pressure (HP) treatment. The cheese intermediate is preferably concentrated milk or curd. As a result, a cheese can be obtained having a higher moisture content, without the undesired softer texture normally associated therewith. This is of particular benefit in improving the organoleptic characteristics of medium fat or low fat cheese.

NL C 2005932

HK P92813NL00

Title: METHOD OF MAKING CHEESE

Field of the Invention

The invention relates to a method of making cheese, particularly of the hard or semi-hard type. The invention further relates to a method of making cheese from concentrated milk. The invention also relates to a method of making low fat or medium fat cheese.

Traditionally, cheese making involves a process wherein milk ingredients are concentrated in order to preserve the ingredients for long periods of time. Many types of cheese exist, each having its own specific production process. Generally, the basic steps in cheese making comprise: providing cheese milk; adding starter cultures; adding a coagulant (rennet type enzymes), coagulation of caseins by proteolytic actions of the coagulant, inducing the milk to form a gel (curd), which becomes separated from a liquid portion (whey); cutting the curd and removing the whey from the curd, thereby concentrating the caseins and the fat; addition of salt; and ripening.

For decades, cheese (and cheese-like products) have been subject to a great variety of improvements. Some are of an economical nature (e.g. to increase yield). One such process is described by Huppertz et al., in Innovative Food Science and Emerging Technologies 5 (2004) 1–8 .Herein a high isostatic pressure treatment is carried out of milk, so as to affect the cheesemaking properties. On the basis of milk subjected to a treatment at 600-800 MPa, curd yield was increased by 25%.

Whilst the foregoing refers to a modification of cheesemaking by a pre-treatment of milk, other modifications relate to treatments of the end-product (cheese), often with the aim to affect ripening. A reference in this respect is Rynne et al., Innovative Food Science and Emerging Technologies 9 (2008) 429–440, describing the high-pressure treatment (400 MPa for 10 min at room temperature) of 1 day old full-fat Cheddar cheese. The reference

relates the treatment to a potential for acceleration of ripening, yet concludes that the treatment is of limited value.

Others modifications in cheesemaking are directed to improving the quality of the product itself (e.g. improvements in taste). Many intended improvements relate to the health benefits of cheese, in which cheese manufacture procedures are modified, for example, in order to produce cheese with enhanced nutritional properties. This includes producing cheese with reduced fat content (low fat or medium fat cheese) and cheese enriched with calcium. Also, modified cheeses and cheese-like products exist that are not formally allowed to be denoted "cheese" in all jurisdictions. Such cheese-like products, e.g., are directed to cheeses of reduced salt content, and/or cheeses having an increased calcium content.

A challenge to the cheese manufacturer that wishes to stay within the regulatory limits of the definition of "cheese" is that the number of variables to change, in order to improve the texture and/or taste of the cheese, is limited accordingly. E.g., some cheeses, in particular low- or medium fat cheese, have an undesirable tough or stiff texture. Attempts to resolve this by increasing the moisture contents of such cheeses, will result in a cheese that is too soft. Thus, it is desired to be able to improve the texture of low fat and medium fat cheese.

Too soft a cheese may also result from attempts to decrease the salt content of cheese and cheese-products. It is desired to be able to produce cheese or cheese-product of reduced salt content, yet with a sufficiently firm texture.

Summary of the Invention

In order to better address one or more of the foregoing desires, the invention, in one aspect, provides a method of making cheese comprising the steps of:

(a) providing milk;

(b) subjecting said milk to a dry-matter increasing treatment so as to form a cheese intermediate, said treatment comprising one or more steps wherein the milk is subjected to the removal of water therefrom;

(c) allowing milk proteins to coagulate so as to form curd;

(d) processing the curd into cheese;

wherein the cheese intermediate is subjected to a high isostatic pressure treatment.

In another aspect, the invention presents the use of a high-pressure treatment for the purpose of improving the texture of cheese, wherein the high-pressure treatment is conducted on a cheese intermediate having a dry-matter content of more than 25% by weight.

In a further aspect, the invention pertains to cheese obtainable by the foregoing process.

Brief description of the Figures

Fig. 1 depicts a graph showing a relationship between modulus and moisture content of standard cheeses.

Fig. 2 shows the change in this relationship resulting from the process of the invention.

Detailed description of the Invention

In a broad sense, the invention pertains to the judicious recognition that a high-pressure treatment is capable of providing a cheese that can have a higher moisture content, without the regular proportional decrease in hardness, i.e. without an undesired softer texture.

Without wishing to be bound by theory, the present inventors believe that the effect requires that the milk has not yet been transformed into cheese. In accordance with the invention, the high-pressure treatment is conducted at a stage in a cheesemaking process that is after the cheese milk has undergone some treatment to reduce the water-content thereof, and before the curd has actually been transformed into cheese.

Herein the removal of water refers to the removal of water in a broad sense. Depending on the stage of the removal, during the cheesemaking process, this water removal can thus refer to e.g. the draining off of whey from the curd. It can also refer to subjecting milk to a water-removal treatment, such as membrane separation, so as to obtain a retentate (concentrated dairy fluid) that can be subjected to cheesemaking.

The present invention will further be described with respect to particular embodiments and with reference to certain drawings but the invention is not limited thereto but only by the claims. Any reference signs in the claims shall not be construed as limiting the scope.

Where the term "comprising" is used in the present description and claims, it does not exclude other elements or steps. Where an indefinite or definite article is used when referring to a singular noun e.g. "a" or "an", "the", this includes a plural of that noun unless something else is specifically stated.

It is furthermore to be noticed that the term "comprising", used in the description and in the claims, should not be interpreted as being restricted to the means listed thereafter; it does not exclude other elements or steps. Also the term “comprising” should not be interpreted as implying a defined order of

steps. Thus, the scope of the expression "a process comprising the steps A, B, and C" should not be limited to processes in which A precedes B and B precedes C. It means that with respect to the present invention, the only relevant steps are A, B, and C in any order, unless otherwise indicated.

Methods and apparatuses for preparing cheese are widely known from practice. In general, cheese is prepared by providing cheese milk, inoculating this with starter bacteria, adding a coagulant such as rennet so as to form curd, subsequently draining the liquid phase (whey), and then forming young cheese from the curd. Then, the young cheese can be subjected to a salt treatment, such as a brine treatment, by bringing it into a brine bath for some time. After it has undergone a salt treatment, such as a brine treatment, the young cheese is usually stored in a cheese warehouse to undergo a controlled ripening process.

The aforementioned coagulation and draining of whey are included in the possible dry-matter increasing step as defined above.

The milk provided can be as is, i.e. not pre-treated. It can also be first concentrated (which is a dry-matter increasing step as defined above) before being inoculated with starter bacteria, coagulated, and transformed in to cheese.

In accordance with the invention, a cheese intermediate is subjected to a high isostatic pressure (HP) treatment. A cheese intermediate is to be understood as being any stage between the milk provided and the cheese obtained that is no longer milk, and not yet cheese. Preferably the cheese intermediate treated in accordance with the invention is either or both of concentrated milk and curd. The cheese intermediate may be inoculated with starter bacteria before or after the treatment.

The milk provided to the process of the invention can, in principle, be from any dairy animal. This is mostly cattle, and particularly cow (adult female cattle), but in addition to cattle, the following animals provide milk used by humans for dairy products: Camels, Donkeys, Goats, Horses, Reindeer,

Sheep, Water buffalo, Yaks, and moose. Most preferably, the milk used in the invention is cow's milk.

In the process of the invention, regular additives can be provided to the milk (or concentrated dairy fluid), whey, and or curd/whey mixture, such as salts (e.g. NaCl, $CaCl_2$), citrate, phosphate, flavors, and other additions as known to the skilled person.

Where cheese is mentioned in the context of the present invention, it is understood as any type of natural cheese. The invention can be applied to any type of cheese. In a preferred embodiment, the invention relates to hard and semi-hard types of cheese, and most preferably to semi-hard cheese. The terms "hard" and "semi-hard" cheese are known to the skilled person, and is generally understood as referring to cheese which is subjected to ripening for at least 4 weeks. An examples of hard cheeses is Parmezan, examples of semi-hard cheeses are Gouda, Edam, Maasdam, Cheddar and Emmental. Reference is made to IDF bulletin 141 1981 ISSN 0250-5118. Examples of soft cheeses are Camembert and Brie.

The invention is applicable to full fat cheese as well as to medium fat and low fat cheese. Many traditional cheeses have fat contents of more than 20 wt%, typically up to 30 wt% (based upon the total weight of the final cheeses). For example, a Gouda cheese has a fat content of about 30 wt% (total weight). Alternatively, the amount of fat may be defined in terms of the dry solids content. For instance, the aforementioned Gouda cheese corresponds to about 50 wt% based upon the dry matter (48+ cheese). According to their fat content, cheeses are classified as follows: high fat: fat in dry matter at least 60 wt%, full fat: fat in dry matter at least 45 wt%, but less than 60 wt%, medium fat: fat in dry matter at least 25 wt%, but less than 45 wt%, partially skimmed: fat in dry matter at least 10 wt%, but less than 25 wt%, skim: fat in dry matter less than 10 wt%.

Natural cheese according to the present invention will be understood to be natural cheese according to the *Codex Alimentarius* definition, Typically,

such natural cheese is the ripened or unripened soft, semi-hard, hard, or extra-hard product, which may be coated, and in which the whey protein/casein ratio does not exceed that of milk, obtained by (a) coagulating wholly or partly the protein of cheese milk (milk, skimmed milk, partly skimmed milk, cream, whey cream or buttermilk, dissolved skimmed milk powder, dissolved full fat milk powder, MPC's (milk protein concentrates), retentates of milk ultrafiltration, retentates of milk microfiltration, or any combinations of these materials), through the action of rennet or other suitable coagulating agents, and by partially draining the whey resulting from the coagulation, while respecting that cheese making results in a concentration of milk protein (in particular, the casein portion), and that consequently, the protein content of the cheese will be distinctly higher then the protein level of the blend of the above milk materials from which the cheese was made; and/or (b) processing techniques involving the coagulation of the protein of milk and/or products obtained from milk which give an end-product with similar physical, chemical and organoleptic characteristics as defined under (a).

The invention has been found particularly suitable for Dutch type varieties such as Gouda, Edam and Maasdam. The Dutch type cheese is defined by Walstra et al. in chapter 2 of "Cheese: Chemistry, Physics and Microbiology, Volume 2, Major cheese Groups, ed. P.F. Fox, Chapman & Hall, ISBN 0 412 53510 6.

Making the cheese of the invention does not require specific equipment other than equipment to subject a cheese intermediate to a high isostatic pressure treatment. All other apparatuses used in cheese making are in accordance with known cheese making methods.

High isostatic pressure (HP) processing of food products generally involves the treatment of a product at a pressure in the range of from 100 to 1000 MPa. HP treatment having been known to the skilled person for well over a century, methods to exert the pressure are well within the ambit of normal skills of the skilled person. Preferably, the pressure is applied as a hydrostatic

pressure, wherein the pressure is exerted onto the product by a surrounding fluid (preferably water). As a result, the product will acquire the pressure of the surrounding medium instantaneously, and the pressure is distributed evenly throughout the product. As the skilled person will be aware, in the case of a liquid product, the HP treatment can be applied with or without the use of a separate processing liquid. In the former case, a processing liquid (preferably water) will be made to surround a product that is in a packaged form (e.g. in a bag). In the latter case, the liquid product itself will also assume the function of the processing liquid. In the context of the invention, this will thus e.g. be a concentrated diary fluid (if the HP treatment is conducted on concentrated dairy fluid), or e.g. whey (if the HP treatment is conducted on curd).

The cheese intermediate subjected to HP treatment according to the invention will generally be a pumpable liquid, ranging from a relatively low viscous liquid (such as concentrated milk), or a curd/whey mixture.

For HP treatments of solid as well as liquid food products many equipments exist. Generally, such equipment comprises a vessel of suitable strength to sustain the pressure (e.g. of stainless steel), and a pressure-generating means. The vessel will hold the product, can have a processing fluid (such as water) surrounding the product, and will have a suitable closure so as to maintain pressure during processing. Hydrostatic pressure will be built up either by pumping additional processing fluid into the vessel (additional fluid leading to increased pressure), or by compressing a fluid surrounding the product by means of a piston. In either case the mass of processing fluid surrounding the product per unit vessel volume will be increased until the desired pressure is reached.

As the skilled person is well aware, systems exist for the HP treatment of solid food products as well as of liquid food products. Systems exist that operate in a batch process, as well as systems that are designed for a continuous process. A continuous system for HP treatment of liquid products is known, e.g. from WO 97/43914.

Preferred pressures applied in accordance with the invention range from 100 to 1000 MPa, preferably 200 to 900 MPa, more preferably 300-600 MPa.

The duration of the HP treatment can be varied. Generally it will be from 0.1 seconds to 15 minutes, preferably 1 minute to 10 minutes. The temperature of the cheese intermediate during the HP treatment can vary. Generally it will be from 4°C to 76°C, preferably 20°C to 50 °C and more preferably 30° to 50°C.

The HP treatment according to the invention is applied onto a cheese intermediate. The cheese intermediate is formed as a result of subjecting milk to a dry-matter increasing treatment.

In one embodiment, the dry-matter increasing treatment refers to the process of coagulation (curdling) of the milk. In that case, the aforementioned steps (b) and (c) comprised in the process of the invention, in fact comprise one and the same process step. I.e., in that case step (b) of subjecting the milk to a dry-matter increasing treatment so as to form a cheese intermediate, said treatment comprising one or more steps wherein the milk is subjected to the removal of water therefrom, coincides with step (c) in which milk proteins are allowed to coagulate so as to form curd.

The method of the invention can be conducted by subjecting the curd to HP, either before or after cutting it and removing whey.

In another embodiment, the dry-matter increasing treatment refers to a process of concentrating milk. To this end, the milk will generally be concentrated so as to have a solids content of at least 25%, preferably at least 30 wt% and more preferably at least 35 wt.%. In one embodiment, the resulting concentrated milk can be subjected to HP treatment, and thereafter be subjected to coagulation and processing into cheese.

Conceivably, in an embodiment of the invention, the two foregoing dry-matter increasing treatments can also be combined. In that case, milk is first concentrated, and then coagulated. In one such an embodiment, the HP treatment can be conducted on the concentrated milk, i.e. before the

coagulation. In another such an embodiment, the HP treatment can be conducted on the coagulated milk, i.e. on the curd. Although it is preferred, e.g. from a point of view of process economy, to conduct a single HP treatment, it will be understood that conceivably a cheese intermediate can be subjected to two or more HP treatments, at different points in time.

Some examples of stages during cheesemaking in which a cheese intermediate can be subjected to HP treatment in accordance with the invention, are depicted in Table 1 below

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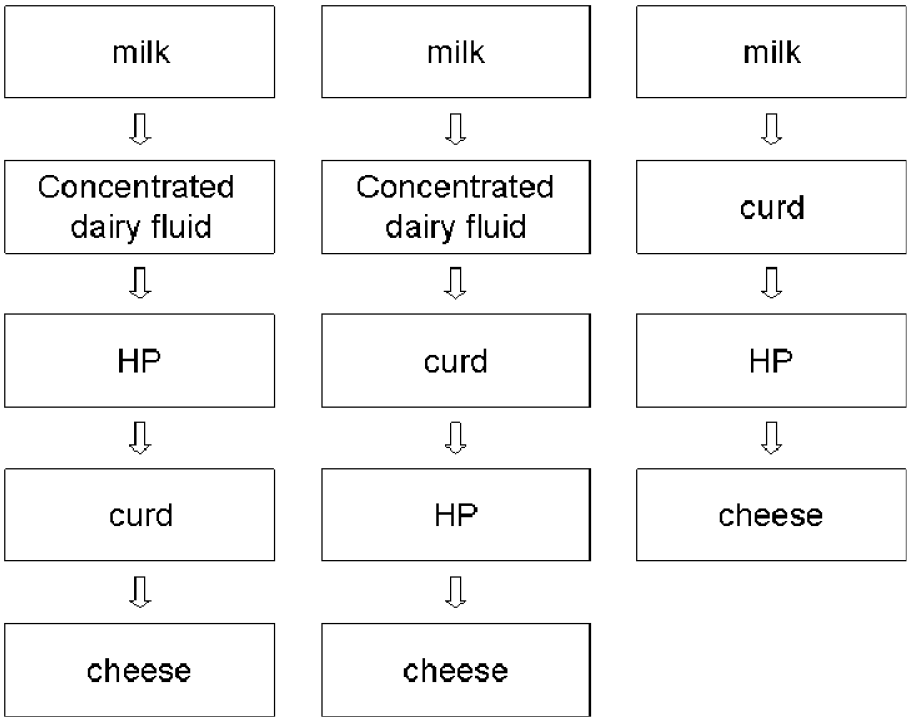
Table 1

Examples of possible processes in accordance with the invention



The method of the invention serves, *inter alia*, to provide a cheese having a higher moisture content, whilst addressing the drawbacks in texture normally associated therewith.

The compression modulus of cheese and cheese-products (which is a parameter indicating the stiffness of the cheese), generally satisfies a relation between moisture content and the solids non-fat content. The process of the invention is capable of producing cheese for which the relationship between moisture content and solids non-fat content deviates from this regular relationship. This deviation is of such a nature that for a cheese of given moisture content, a higher modulus will result than given by the existing relationship between moisture and solids non-fat. Or, *vice versa*, a moisture content that can be higher without negatively affecting the modulus, for a cheese of given solids non-fat content.

In a regular cheese, the compression modulus is determined as a relationship between moisture content and solids, non-fat content. For a regular, Dutch type of cheese, at pH 5.1-5.5, this relation is depicted in Figure 1. On the x-axis the ratio between water and solids non fat (SNF) is given. The y-axis presents the compression modulus (log E). It is clear that at a higher moisture content (higher ratio water to SNF), the modulus decreases

The process of the invention results in a cheese in which the relation between the compression modulus and the SNF content is improved, in the sense that at a same moisture content, a higher modulus is found. Or, *vice versa*, that a cheese of the same modulus prepared according to the invention has a higher moisture content.

In a further aspect, the invention therefore pertains to cheese obtainable by the process as substantially described hereinbefore. The cheese of the invention can be distinguished from cheese not produced in accordance with the invention, by a comparative measurement of the compression modulus. The relationship as depicted holds for Goiuda type cheese, irrespective of the fat content. Also other types of cheese, e.g. Cheddar yield the same relation, depicted in an identical graph. It is conceivable that for other types of cheese the absolute values for the relationship between compression modulus and moisture may be different. For a given type of cheese, however, a standard

value can be determined. A cheese obtainable by the process of the invention will have, at given moisture content, a value for the compression modulus that exceeds the standard value.

In view of the greater benefit on texture as a result of the more beneficial relationship between moisture content and compression modulus, the cheese obtainable by the process of the invention is preferably a medium fat or low fat cheese.

The skilled person is well aware how to determine the compression modulus of a fluid. Typically, this is measured by uniaxial compression as is known to the skilled person (ref. Luyten Rheological and fracture behaviour of Gouda cheese, 1988. thesis Wageningen University 1988).

In respect of the foregoing, it is to be understood that the fat content, which regularly defines a type of cheese, as explained above, normally correlates with the solids non-fat content. Thus, the invention will have a particular benefit in that for each type of cheese, i.e. defined in terms of fat and solids non-fat, a higher amount of water can be incorporated. Whilst this can be desired across the range of available cheese types, the benefits of the invention are best enjoyed with medium fat or low fat cheese. For these types of cheeses, the higher moisture content serves to address the otherwise less than optimal texture, without the drawback of obtaining too soft a cheese. The resulting texture resembles that of a cheese with a lower moisture content. E.g., a 20+ Gouda cheese which normally has a moisture content of about 53 wt/% can be prepared in accordance with the invention so as to have a moisture content of 56%. This is a substantial increase that serves to make the cheese more palatable, and the invention provides this together with a cheese texture resembling that of regular 20+ cheese, i.e. without the softness that would normally result from a higher moisture content. It will be understood that the absolute moisture content can be affected as is done in regular cheesemaking, and as is known to the skilled person. The HP treatment of according to the invention will result in additional moisture being retained.

In addition, the method of the invention also serves to address cheese flavor. E.g., resulting in a more mature cheese flavor. A reference to definitions of sensory and mechanical properties of cheese is A.A. Foegeding and M.A. Drake, J. Dairy Sci. 90:1611-1624 (2007), pages 1611-1624.

The invention, in another aspect, resides in the use of a high-pressure (HP) treatment for the purpose of improving the texture of cheese, wherein the high-pressure treatment is conducted on a cheese intermediate having a dry-matter content of more than 25% by weight. The cheese intermediate is to be understood in the sense as explained above. I.e., typical cheese intermediates for which the HP treatment can be used, are concentrated milk or curd. The dry-matter content of the cheese intermediate is preferably at least 25 wt.

In embodiments where the cheese intermediate is concentrated dairy fluid, the dry-matter content preferably is at least 30 wt. % and more preferably at least 35 wt. %. It will be understood that the dry-matter content will not exceed the dry matter content of the cheese to be produced, i.e. having a moisture content higher or equal to that normal for cheese. Preferably, in embodiments where the HP treatment of the invention is conducted on curd as a cheese intermediate, the moisture content of the curd/whey mixture is preferably at least 5 wt. % higher than that of cheese and more preferably at least 10 wt. % higher.

The invention will hereinafter be further illustrated with reference to the following, non-limiting examples.

Example 1

Cheese curd was made from milk with ~1% fat, rennet and a starter culture as usual with the intention to make a 20+ Gouda type cheese. A whey/curd mixture with a ration of about 1.5 was HP treated (300 MPa, 10 minutes, room temperature). The treatment occurred directly after adding the washing water or later, up to 2 hours after washing normally ended. After HP

treatment the curd was collected in a cheese mould, pressed and brined as usual. Moisture content and a description of the texture and taste of the cheese are given in Table 2 below.

The HP treated cheese was softer, more melting and less rubbery, all improvements for a low fat Gouda type cheese. The HP treated cheese was less soft than expected from the moisture content (see Figure 2).
Surprisingly the HP treated cheese was found to have a different taste, e.g. more cheese-like but also some bitterness was found.

Table 2

Moisture contents and texture of cheese after HP treatment of curd

test number	moisture content wt% after brining		change in texture/taste
	no HP	HP treatment	judged after 4 weeks ripening
1	53,7 54,2	56,8 56,8 58,1	softer (but less then expected from moisture content), not rubbery or crumbly, more cheese taste
2	52,0	58,1 54,9	softer (but less then expected from moisture content), more cheese taste, somewhat bitter
3	50,8	54,7 54,5	softer, more melting, more cheese-taste
4	51,5	55,0 56,0	more cheese like taste, less rubbery, some melting

CONCLUSIES

1. Werkwijze voor het maken van kaas omvattende de stappen:

(a) het verschaffen van melk;

(b) het onderwerpen van genoemde melk aan een droge-stof-verhogende behandeling teneinde een kaas-tussenproduct te vormen, waarbij genoemde behandeling een of meer stappen omvat waarin de melk wordt blootgesteld aan het eruit verwijderen van water;

(c) het laten coaguleren van melkeiwitten ter vorming van wrongel;

(d) het verwerken van de wrongel tot kaas;

waarbij het kaas-tussenproduct wordt onderworpen aan een behandeling met hoge isostatische druk.

2. Werkwijze volgens conclusie 1, waarbij het aan de hoge isostatische drukbehandeling onderworpen kaas-tussenproduct een droge-stof gehalte heeft van tenminste 25 gew.%.

3. Werkwijze volgens conclusie 1 of 2, waarbij het aan de hoge isostatische drukbehandeling onderworpen kaas-tussenproduct geconcentreerde melk is.

4. Werkwijze volgens conclusie 3, waarbij de geconcentreerde melk een droge-stof gehalte heeft van tenminste 30 gew.%, bij voorkeur tenminste 35 gew.%.

5. Werkwijze volgens een der voorgaande conclusies, waarbij het aan de hoge isostatische drukbehandeling onderworpen kaas-tussenproduct wrongel is.

6. Werkwijze volgens conclusie 5, omvattende de stappen:

(a) het verschaffen van melk;

(b) het concentreren van genoemde melk;

(c) het laten coaguleren van melkeiwitten in de geconcentreerde melk ter vorming van wrongel;

(d) het verwerken van de wrongel tot kaas.

7. Werkwijze volgens een der voorgaande conclusies, waarbij de hoge isostatische drukbehandeling wordt uitgevoerd door op het kaas-tussenproduct een hydrostatische druk uit te oefenen van 200 tot 900 MPa, bij voorkeur 300-600 MPa.

8. Werkwijze volgens een der voorgaande conclusies, waarbij de kaas een Nederlands type kaassoort is, bij voorkeur gekozen uit de groep bestaande uit Gouda, Edam, en Maasdam.

9. Werkwijze volgens een der voorgaande conclusies, waarbij de kaas een halfvette of laagvette kaas is.

10. Werkwijze volgens een der voorgaande conclusies, waarbij de HP behandeling wordt uitgevoerd met een duur van 0.1 seconden tot 15 minuten, bij voorkeur 1 minuut tot 10 minuten.

11. Werkwijze volgens een der voorgaande conclusies, waarbij de HP behandeling wordt uitgevoerd bij een temperatuur van 4°C tot 76°C.

12. Werkwijze volgens conclusie 11, waarbij de temperatuur 20°C tot 50°C is, bij voorkeur 30°C tot 50°C.

13. De toepassing van een hoge-druk (HP) behandeling voor het doel de textuur van kaas te verbeteren, waarbij de hoge-druk behandeling wordt uitgevoerd op een kaas-tussenproduct met een droge-stof gehalte van meer dan 25 gewichts%.

Fig. 1

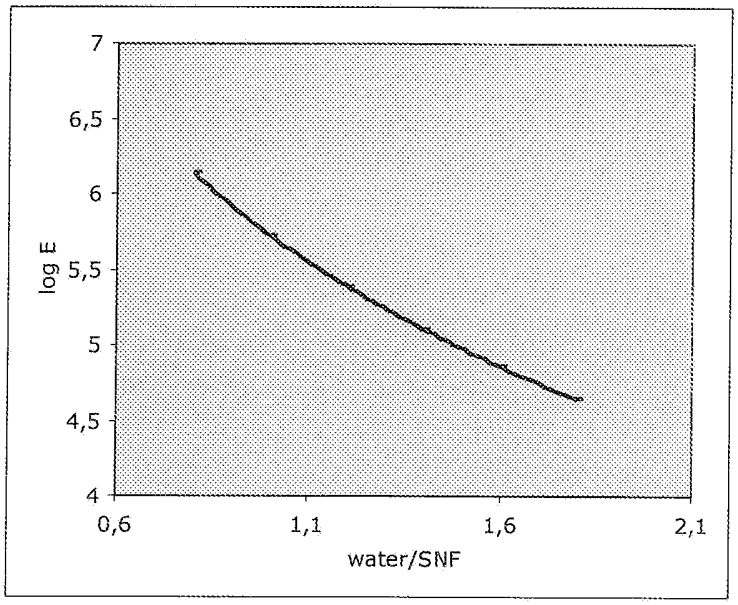
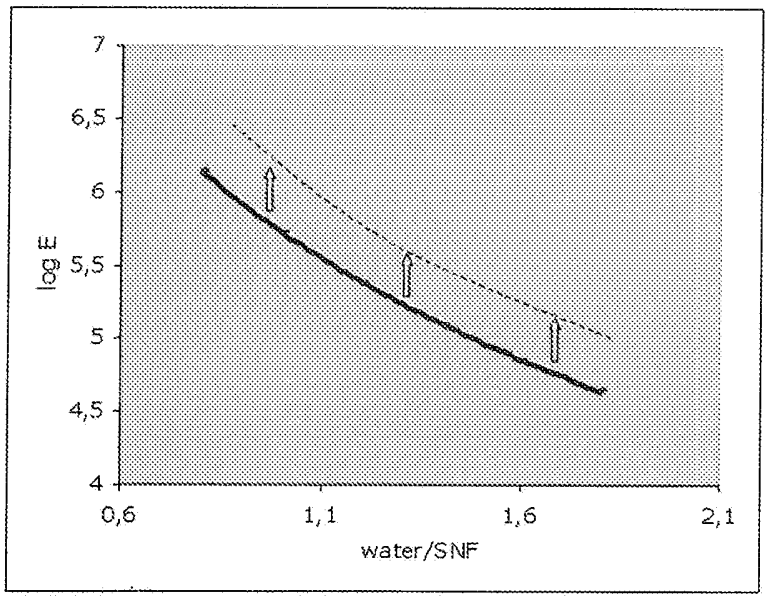

7
6,5
6
log E 5,5
5
4,5
4
0,6
1,1
1,6
2,1
water/SNF

Fig. 2


7
6,5
6
log E 5,5
5
4,5
4
0,6
1,1
1,6
2,1
water/SNF

SAMENWERKINGSVERDRAG (PCT)

RAPPORT BETREFFENDE NIEUWHEIDSONDERZOEK VAN INTERNATIONAAL TYPE

IDENTIFICATIE VAN DE NATIONALE AANVRAGE	KENMERK VAN DE AANVRAGER OF VAN DE GEMACHTIGDE
	P92813NL00
Nederlands aanvraag nr. **2005932**	Indieningsdatum **29-12-2010**
	Ingeroepen voorrangsdatum
Aanvrager (Naam) **Friesland Brands B.V.**	
Datum van het verzoek voor een onderzoek van internationaal type **29-04-2011**	Door de Instantie voor Internationaal Onderzoek aan het verzoek voor een onderzoek van internationaal type toegekend nr. **SN56056**

I. CLASSIFICATIE VAN HET ONDERWERP (bij toepassing van verschillende classificaties, alle classificatiesymbolen opgeven)

Volgens de internationale classificatie (IPC)

A23C19/05 **A23C19/06**

II. ONDERZOCHTE GEBIEDEN VAN DE TECHNIEK

Onderzochte minimumdocumentatie

Classificatiesysteem	Classificatiesymbolen
IPC	**A23C**

Onderzochte andere documentatie dan de minimum documentatie, voor zover dergelijke documenten in de onderzochte gebieden zijn opgenomen

III.	☐ **GEEN ONDERZOEK MOGELIJK VOOR BEPAALDE CONCLUSIES**	(opmerkingen op aanvullingsblad)
IV.	☐ **GEBREK AAN EENHEID VAN UITVINDING**	(opmerkingen op aanvullingsblad)

ONDERZOEKSRAPPORT BETREFFENDE HET RESULTAAT VAN HET ONDERZOEK NAAR DE STAND VAN DE TECHNIEK VAN HET INTERNATIONALE TYPE

Nummer van het verzoek om een onderzoek naar de stand van de techniek
NL 2005932

A. CLASSIFICATIE VAN HET ONDERWERP
INV. A23C19/05 A23C19/06
ADD.

Volgens de Internationale Classificatie van octrooien (IPC) of zowel volgens de nationale classificatie als volgens de IPC.

B. ONDERZOCHTE GEBIEDEN VAN DE TECHNIEK

Onderzochte miminum documentatie (classificatie gevolgd door classificatiesymbolen)
A23C

Onderzochte andere documentatie dan de mimimum documentatie, voor dergelijke documenten, voor zover dergelijke documenten in de onderzochte gebieden zijn opgenomen

Tijdens het onderzoek geraadpleegde elektronische gegevensbestanden (naam van de gegevensbestanden en, waar uitvoerbaar, gebruikte trefwoorden)
EPO-Internal, FSTA, BIOSIS, WPI Data

C. VAN BELANG GEACHTE DOCUMENTEN

Categorie °	Geciteerde documenten, eventueel met aanduiding van speciaal van belang zijnde passages	Van belang voor conclusie nr.
A	MOLINA ELENA ET AL: "Use of high-pressure-treated milk for the production of reduced-fat cheese", INTERNATIONAL DAIRY JOURNAL, deel 10, nr. 7, oktober 2000 (2000-10), bladzijden 467-475, XP002660123, ISSN: 0958-6946 * Conclusions; bladzijde 474; tabel 5 *	1-13

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[X] Verdere documenten worden vermeld in het vervolg van vak C.

[X] Leden van dezelfde octrooifamilie zijn vermeld in een bijlage

° Speciale categorieën van aangehaalde documenten

"A" niet tot de categorie X of Y behorende literatuur die de stand van de techniek beschrijft

"D" in de octrooiaanvrage vermeld

"E" eerdere octrooi(aanvrage), gepubliceerd op of na de indieningsdatum, waarin dezelfde uitvinding wordt beschreven

"L" om andere redenen vermelde literatuur

"O" niet-schriftelijke stand van de techniek

"P" tussen de voorrangsdatum en de indieningsdatum gepubliceerde literatuur

"T" na de indieningsdatum of de voorrangsdatum gepubliceerde literatuur die niet bezwarend is voor de octrooiaanvrage, maar wordt vermeld ter verheldering van de theorie of het principe dat ten grondslag ligt aan de uitvinding

"X" de conclusie wordt als niet nieuw of niet inventief beschouwd ten opzichte van deze literatuur

"Y" de conclusie wordt als niet inventief beschouwd ten opzichte van de combinatie van deze literatuur met andere geciteerde literatuur van dezelfde categorie, waarbij de combinatie voor de vakman voor de hand liggend wordt geacht

"&" lid van dezelfde octrooifamilie of overeenkomstige octrooipublicatie

Datum waarop het onderzoek naar de stand van de techniek van internationaal type werd voltooid	Verzenddatum van het rapport van het onderzoek naar de stand van de techniek van internationaal type
27 september 2011	

Naam en adres van de instantie	De bevoegde ambtenaar
European Patent Office, P.B. 5818 Patentlaan 2 NL – 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Vermeulen, Stéphane

2

Formulier PCT/ISA/201 (tweede blad) (Januari 2004)

ONDERZOEKSRAPPORT BETREFFENDE HET RESULTAAT VAN HET ONDERZOEK NAAR DE STAND VAN DE TECHNIEK VAN HET INTERNATIONALE TYPE

Nummer van het verzoek om een onderzoek naar de stand van de techniek
NL 2005932

C.(Vervolg). VAN BELANG GEACHTE DOCUMENTEN

Categorie °	Geciteerde documenten, eventueel met aanduiding van speciaal van belang zijnde passages	Van belang voor conclusie nr.
A	DRAKE M A ET AL: "High Pressure Treatment of Milk and Effects on Microbiological and Sensory Quality of Cheddar Cheese", JOURNAL OF FOOD SCIENCE, deel 62, nr. 4, 1 januari 1997 (1997-01-01), bladzijden 843-845,860, XP002166808, WILEY-BLACKWELL PUBLISHING, INC, US ISSN: 0022-1147, DOI: 10.1111/J.1365-2621.1997.TB15468.X * bladzijde 845, linker kolom, alinea 4 * * Conclusions; bladzijde 845 *	1-13
A	KHEADR E E ET AL: "EFFECT OF DYNAMIC HIGH PRESSURE ON MICROBIOLOGICAL, RHEOLOGICAL AND MICROSTRUCTURAL QUALITY OF CHEDDAR CHEESE", INTERNATIONAL DAIRY JOURNAL, deel 12, nr. 5, 1 januari 2002 (2002-01-01), bladzijden 435-446, XP001176606, ELSEVIER APPLIED SCIENCE, BARKING, GB ISSN: 0958-6946, DOI: 10.1016/S0958-6946(01)00104-2 * Conclusions; bladzijde 445 *	1-13
A	SALDO J ET AL: "Hard cheese structure after a high hydrostatic pressure treatment at 50 MPa for 72 h applied to cheese after brining.", LAIT, deel 81, nr. 5, augustus 2001 (2001-08), bladzijden 625-635, XP002660124, * Conclusion; bladzijde 634 *	1-13
A	MESSENS W ET AL: "Rheological properties of high-pressure-treated Gouda cheese.", INTERNATIONAL DAIRY JOURNAL, deel 10, nr. 5/6, 2000, bladzijden 359-367, XP002660125, DOI: 10.1016/S0958-6946(00)00066-2 * Conclusions; bladzijde 366 *	1-13

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ONDERZOEKSRAPPORT BETREFFENDE HET RESULTAAT VAN HET ONDERZOEK NAAR DE STAND VAN DE TECHNIEK VAN HET INTERNATIONALE TYPE

Nummer van het verzoek om een onderzoek naar de stand van de techniek
NL 2005932

C.(Vervolg). VAN BELANG GEACHTE DOCUMENTEN

Categorie °	Geciteerde documenten, eventueel met aanduiding van speciaal van belang zijnde passages	Van belang voor conclusie nr.
A	SALDO J ET AL: "HIGH HYDROSTATIC PRESSURE FOR ACCELERATING RIPENING OF GOAT'S MILK CHEESE: PROTEOLYSIS AND TEXTURE", JOURNAL OF FOOD SCIENCE, deel 65, nr. 4, 1 mei 2000 (2000-05-01), bladzijden 636-640, XP000958010, WILEY-BLACKWELL PUBLISHING, INC, US ISSN: 0022-1147, DOI: 10.1111/J.1365-2621.2000.TB16064.X * Conclusions; bladzijde 639 *	1-13
A	EP 0 469 857 A1 (FUJI OIL CO LTD [JP]) 5 februari 1992 (1992-02-05) * het gehele document *	1-13

ONDERZOEKSRAPPORT BETREFFENDE HET RESULTAAT VAN HET ONDERZOEK NAAR DE STAND VAN DE TECHNIEK VAN HET INTERNATIONALE TYPE

Informatie over leden van dezelfde octrooifamilie

Nummer van het verzoek om een onderzoek naar de stand van de techniek
NL 2005932

In het rapport genoemd octrooigeschrift	Datum van publicatie	Overeenkomend(e) geschrift(en)	Datum van publicatie
EP 0469857 A1	05-02-1992	DE 69101093 D1	10-03-1994
		DE 69101093 T2	05-05-1994
		DK 0469857 T3	14-03-1994
		JP 4088946 A	23-03-1992
		JP 6042814 B	08-06-1994
		US 5180596 A	19-01-1993

OCTROOICENTRUM NEDERLAND

WRITTEN OPINION

File No.	Filing date *(day/month/year)*	Priority date *(day/month/year)*	Application No.
SN56056	29.12.2010		NL2005932

International Patent Classification (IPC)
INV. A23C19/05 A23C19/06

Applicant
Friesland Brands B.V.

This opinion contains indications relating to the following items:

- ☒ Box No. I Basis of the opinion
- ☐ Box No. II Priority
- ☐ Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- ☐ Box No. IV Lack of unity of invention
- ☒ Box No. V Reasoned statement with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- ☐ Box No. VI Certain documents cited
- ☐ Box No. VII Certain defects in the application
- ☐ Box No. VIII Certain observations on the application

	Examiner

Application number

WRITTEN OPINION

NL2005932

Box No. I Basis of this opinion

1. This opinion has been established on the basis of the latest set of claims filed before the start of the search.

2. With regard to any **nucleotide and/or amino acid sequence** disclosed in the application and necessary to the claimed invention, this opinion has been established on the basis of:

   a. type of material:

   ☐ a sequence listing

   ☐ table(s) related to the sequence listing

   b. format of material:

   ☐ on paper

   ☐ in electronic form

   c. time of filing/furnishing:

   ☐ contained in the application as filed.

   ☐ filed together with the application in electronic form.

   ☐ furnished subsequently for the purposes of search.

3. ☐ In addition, in the case that more than one version or copy of a sequence listing and/or table relating thereto has been filed or furnished, the required statements that the information in the subsequent or additional copies is identical to that in the application as filed or does not go beyond the application as filed, as appropriate, were furnished.

4. Additional comments:

Box No. V Reasoned statement with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty	Yes:	Claims	1-13
	No:	Claims	
Inventive step	Yes:	Claims	1-13
	No:	Claims	
Industrial applicability	Yes:	Claims	1-13
	No:	Claims	

2. Citations and explanations

see separate sheet

Re Item V

Reasoned statement with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

Reference is made to the following documents:

D1 MOLINA ELENA ET AL: "Use of high-pressure-treated milk for the production of reduced-fat cheese",
INTERNATIONAL DAIRY JOURNAL,
deel 10, nr. 7, 2000, bladzijden 467-475,
ISSN: 0958-6946

D2 DRAKE M A ET AL: "High Pressure Treatment of Milk and Effects on Microbiological and Sensory Quality of Cheddar Cheese",
JOURNAL OF FOOD SCIENCE, WILEY-BLACKWELL PUBLISHING, INC, US,
deel 62, nr. 4, 1 januari 1997 (1997-01-01), bladzijden 843-845,860,
XP002166808,
ISSN: 0022-1147, DOI: 10.1111/J.1365-2621.1997.TB15468.X

D3 KHEADR E E ET AL: "EFFECT OF DYNAMIC HIGH PRESSURE ON MICROBIOLOGICAL, RHEOLOGICAL AND MICROSTRUCTURAL QUALITY OF CHEDDAR CHEESE",
INTERNATIONAL DAIRY JOURNAL, ELSEVIER APPLIED SCIENCE, BARKING, GB,
deel 12, nr. 5, 1 januari 2002 (2002-01-01), bladzijden 435-446,
XP001176606,
ISSN: 0958-6946, DOI: 10.1016/S0958-6946(01)00104-2

D4 SALDO J ET AL: "Hard cheese structure after a high hydrostatic pressure treatment at 50 MPa for 72 h applied to cheese after brining.",
LAIT 2001 CORRESPONDENCE (REPRINT) ADDRESS, B. GUAMIS, CER PLANTA DE TEC. DELS ALIMENTS, CERTA, XIT, DEP. DE CIENCIA ANIMAL I DELS ALIMENTS, FAC. DE VET., UNIV. AUTONOMA DE BARCELONA, BARCELONA, SPAIN. TEL. (34) 9 35 81 14 47. FAX (34) 9 35 81 20 0,
deel 81, nr. 5 , bladzijde 625,

D5 MESSENS W ET AL: "Rheological properties of high-pressure-treated Gouda cheese.",
INTERNATIONAL DAIRY JOURNAL 2000 CORRESPONDENCE

(REPRINT) ADDRESS, K. DEWETTINCK, DEP. OF FOOD TECH. & NUTR., FAC. OF AGRIC. & APPLIED BIOL. SCI., GHENT UNIV., B-9000 GHENT, BELGIUM. TEL. +32-9-264-61-65. FAX +32-9-264-62-18. E-MAIL KOEN.DEWETTINC,
deel 10, nr. 5/6 , bladzijde 359,

D6 SALDO J ET AL: "HIGH HYDROSTATIC PRESSURE FOR ACCELERATING RIPENING OF GOAT'S MILK CHEESE: PROTEOLYSIS AND TEXTURE",
JOURNAL OF FOOD SCIENCE, WILEY-BLACKWELL PUBLISHING, INC, US,
deel 65, nr. 4, 1 mei 2000 (2000-05-01), bladzijden 636-640,
XP000958010,
ISSN: 0022-1147, DOI: 10.1111/J.1365-2621.2000.TB16064.X

D7 EP 0 469 857 A1 (FUJI OIL CO LTD [JP]) 5 februari 1992 (1992-02-05)

The method and use according to the independent claims 1 and 13 are not disclosed by any of the prior art documents D1-D7 and accordingly meet the requirement of novelty. D1-D7 disclose cheesemaking methods involving a high isostatic pressure treatment. The disclosure of said documents however differs in that the pressure treatment is not applied on a cheese intermediate as defined in the claims, but on the milk (D1-D3) or on the resulting cheese (D4-D7).

The problem to be solved by the present invention was the provision of a new method for cheesemaking leading to improved cheese texture, particularly in fat reduced hard and semi-hard cheeses. This problem is solved by the method and use defined in the pending claims 1 and 13, which is characterised by subjecting a cheese intermediate to high isostatic pressure, said cheese intermediate being obtained by the removal of water from the starting milk.

Closest state of the art is represented by D1, which deals with the same problem of improving the texture of fat-reduced cheeses. To this effect D1 teaches to subject the starting milk to a high isostatic pressure treatment. D1 does not suggest to apply the isostatic pressure treatment to milk from which part of the water has been removed. Starting from D1 the presently claimed method and use represent a non-obvious and

therefore inventive alternative, as there is no incentive in D1 which would have prompted the skilled person to apply the high pressure treatment to milk which has first been subjected to a water removal step in order to increase its dry-matter content.

Also the state of the art disclosed in D2-D7 does not provide indications which would lead a skilled person to the claimed alternative process. Similarly as in D1, the teaching of D2 and D3 is directed to high pressure treatment of the milk without dry-matter content increase. D4-D7 suggest to apply the high isostatic pressure treatment on the cheese itself in order to accelerate ripening and/or modifying the cheese texture by increasing its moisture content. Generally, the processes disclosed in D1-D7 are found to result in a cheese having softer texture due to increased moisture content. The alternative process claimed by the pending application however allows to increase moisture content without softening the texture (cf. page 10, line 16 - page 11, line 10 ; page 12, lines 22-27), which is of particular advantage in a fat-reduced hard or semi-hard cheese, such as Gouda.

Claims 2-12 are dependent on claim 1 and as such also meet the requirements of novelty and inventive step.

The subject-matter of claims 1-13 is considered to be applicable in the food industry and thus meets the requirement of industrial applicability.