

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization

International Bureau



(10) International Publication Number

WO 2016/114657 A1

(43) International Publication Date

21 July 2016 (21.07.2016)

AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IR, IS, JP, KE, KG, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(51) International Patent Classification:

A23C 19/00 (2006.01) A23C 19/09 (2006.01)  
A23C 19/06 (2006.01)

(21) International Application Number:

PCT/NL2016/050025

(22) International Filing Date:

13 January 2016 (13.01.2016)

(25) Filing Language:

English

(26) Publication Language:

English

(30) Priority Data:

15150983.3 13 January 2015 (13.01.2015) EP

(71) Applicant: COÖPERATIE AVEBE U.A. [NL/NL]; Prins Hendrikplein 20, 9641 GK Veendam (NL).

(72) Inventors: BUWALDA, Pieter Lykle; c/o Prins Hendrikplein 20, 9641 GK Veendam (NL). VAN DEN AKKER-BLEUMINK, Bernarda; c/o Prins Hendrikplein 20, 9641 GK Veendam (NL). MULDER, Frederik; c/o Prins Hendrikplein 20, 9641 GK Veendam (NL).

(74) Agent: JANSEN, C.M.; V.O., Carnegieplein 5, 2517 KJ Den Haag (NL).

(81) Designated States (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM,

(84) Designated States (unless otherwise indicated, for every kind of regional protection available): ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, ST, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

Published:

- with international search report (Art. 21(3))
- before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments (Rule 48.2(h))



WO 2016/114657 A1

(54) Title: SPREADABLE CHEESE FROM CURD.

(57) Abstract: The invention relates to the field of cheese making, in particular to the production of a soft cheese or a spreadable cheese. Provided is a method for preparing a spreadable cheese product, comprising the steps of (a) coagulating wholly or partly the protein of a milk product through the action of rennet or other suitable coagulating agents; (b) partially draining the whey resulting from the coagulation to obtain a cheese curd; (c) preparing a mixture of the cheese curd, water, an amylose-treated starch (ATS) and a pregelatinized starch (PS); (d) heating and shearing the mixture at a temperature between 70 and 80° C; followed by (e) cooling the mixture under stirring to obtain a spreadable cheese product. Also provided is a spreadable cheese obtainable by the method.

Title: Spreadable cheese from curd.

5 The invention relates to the field of cheese making, in particular to the production of a soft cheese or a spreadable cheese.

Conventional semi hard/hard cheese processing involves the formation of a cheese curd from milk. Customarily, pasteurized milk is inoculated with a cheese starter culture of a selected micro-organism, 10 optionally pre-acidifying the milk, adding rennet or another suitable coagulant to the milk to form a curd. Thereafter, the coagulated milk is subjected to cutting and draining to remove excess whey from the curd.

Curd processing in semi hard/hard cheese manufacture, to obtain e.g. Cheddar, Gouda or Edam, comprises removal of residual whey by 15 heating, stirring and washing the cheese curd until it is a homogeneous mass having a moisture content that meets the appropriate standard for the cheese being made. The drained curd is pressed and brined. The exact processes in the making of cheese varies between different cheese varieties. For soft cheeses, the curds are sparingly cut and allowed to drain naturally. 20 For hard cheeses, the curds are typically heated and more whey is drained off. Most important common feature is that all are processed through a cut curd.

Although the demand of a particular cheese can vary, the cheese production level, and hence the curd production, in the cheese industry is 25 kept at a constant high in order to balance milk supply. This typically leads to scrap cheese, which needs rework in low value processed cheese and cheese analogues.

In order to prevent unwanted cheese from going to waste, the present inventors sought to redirect curd that is originally intended or 30 suitable for making a hard cheese into a process leading to a desirable cheese product. This offers the producer the opportunity to maintain

production and milk demand, while adapting the output of the cheese type to market demand. As a result, less waste is produced and less rework is necessary.

Surprisingly, it has been found that curd intended or suitable for 5 converting into a hard cheese can be processed to a spreadable cheese with the aid of a specific combination of starches. More in particular, the incorporation of at least an amylomaltase-treated starch and a pregelatinized starch resulted in a stable product having a good consistency, a good spreadability and an attractive creaminess.

10

Accordingly, in one embodiment the invention provides a method for preparing a spreadable cheese product, comprising the steps of (a) coagulating wholly or partly the protein of a milk product through the action of rennet or other suitable coagulating agents; (b) partially draining the 15 whey resulting from the coagulation to obtain a cheese curd; (c) preparing a mixture of the cheese curd, water, an amylomaltase-treated starch (ATS) and a pregelatinized starch (PS); (d) heating and shearing the mixture at a temperature between 70 and 80°C followed by (e) cooling the mixture under stirring to obtain a spreadable cheese product.

20 Steps (a) and (b) of a method of the present invention involve the manufacture of a curd from a milk product according to methods known in the art. Any type of milk product can be used as starting material. In one embodiment, the milk product is skimmed milk, partly skimmed milk, cream, whey cream or buttermilk, or a combination of these materials.

25 Typically, the milk product is obtained from cow, buffalo, goat or sheep. In a preferred aspect, raw cow's milk is used. For example, raw cow's milk is pasteurized by heating at 72°C for 15 seconds to destroy potentially harmful bacteria. The milk is then cooled to around 30°C.

It is of note that a process of the invention is clearly distinct from the classical way of preparing a spreadable cheese like a cream cheese from milk and cream wherein involving the separation of a fermented dairy blend into a (semi-solid) curd fraction and a liquid whey using centrifugation or 5 ultrafiltration. An overview of different processes is described in US2013/273202 A1. Unexpectedly, the present inventors observed that a cut curd, which went via a pathway distinct from that of the regular cream cheese process, can be reconstituted in such a way that a spreadable cheese is obtained provided that a specific combination of starches is added.

10 WO2012/080150 discloses a spreadable gel which comprises 0.5 to 8 wt% of an amylose treated starch, 0.5 to 8 wt% of a waxy starch, water and optionally a basic ingredient such as fruit, vegetable or soy. WO2012/080150 is primarily concerned with jams (jellies) and gel-like 15 sauces which, when heated, such as in a microwave oven, become liquid and can be used as liquid sauce for preparing the meals. Nothing is mentioned about the manufacture of a spreadable cheese employing a starch blend of 20 the present invention.

In step (a) the protein of a milk product is coagulated wholly or partly 25 through the action of rennet or any other suitable coagulating agent(s) according to methods known in the art. The step of coagulation is effected by the action of "rennet", i.e. a suitable milk coagulating enzyme or mixture of enzymes of animal and/or microbial origin or other suitable milk coagulating agent. Rennet is added in sufficient quantity to induce coagulation in 5 to 30 minutes. The strength of different rennets can vary, though usual strength varies between 50 to 2500 IMCU(International milk clotting unit) .To 30 facilitate dispersion the rennet may be diluted in pure water. Following rennet addition the retentate is agitated thoroughly and allowed to undergo quiescent coagulation. For example, step (a) comprises incubating the milk product with rennet and a food grade acidulant under conditions allowing

for casein coagulation.

A starter culture of lactic acid bacteria may be added to help souring. These convert lactose into lactic acid and help in the coagulation process. The 5 acidification of milk in cheese making by means of bacteria is called ripening. A variety of bacteria cultures are available for making specific cheese types. These bacteria, commonly called starter cultures, are added to the milk after pasteurization and at specific temperatures. They are allowed to work for specific time periods depending on the type of cheese. During 10 this period the bacteria consumes the lactose which is milk sugar. As the bacteria eat, they produce lactic acid which in turn causes the milk protein to develop into curd. Other byproducts of this ripening stage provide flavor compounds which enhance the character of the finished cheese.

Following addition of the curdling ingredients, the milk is allowed to curdle 15 under the appropriate conditions. For example, the milk is incubated for about 30 minutes at around 35°C. When the desired firmness is obtained, the curd can be cut into small pieces, followed by stirring and resting. In step (b) of a method of the invention, the whey resulting from the coagulation is partially drained to obtain a cheese curd.

20 Following curd formation, a mixture is prepared by adding water, an amylose-treated starch (ATS) and a pregelatinized starch (PS) to the cheese curd, optionally salts, ascorbic acid and / or lactic acid can be added. In the normal process for hard cheese, as mentioned earlier, the curd is either kneaded or pressed and optionally ripened to obtain the end product.

25 In contrast, in the present invention the curd mixture is put in a high shear cooker and sheared and heated to 72 °C optionally applying steam. The heating is continued until the mass is homogeneous. Then the resulting mixture is filled into containers for storage, usually in a refrigerator.

As described herein above, the invention is characterized among others by the addition of amyloamaltase-treated starch and pregelatinized starch to a cut cheese curd.

The production of amyloamaltase treated starch has been described 5 in the art, see for example EP 0932444 B1. In one embodiment, an amylose-containing starch is converted by an  $\alpha$ -1-4,  $\alpha$ -1-4 glucanotransferase (amyloamaltase) to a chain elongated amylopectin. The typical and relevant activity of the amyloamaltase is that they are capable of breaking an  $\alpha$ -1,4 bond between two glucose units to subsequently make a novel  $\alpha$ -1,4 bond. In 10 the end the amylose is reattached to the amylopectin resulting in the desired product. The product forms thermoreversible gels in low concentrations in water.

In one aspect, the amyloamaltase treated starch can be prepared from suspension of potato starch in water (19 - 20 % w/w). This suspension 15 is jet-cooked at 150 - 160°C in order to dissolve the starch. The product is cooled in vacuo to 70°C. Flash cooling is a preferred option. The pH is adjusted to 6.2 using for example 6N H<sub>2</sub>SO<sub>4</sub>. Then amyloamaltase (2 ATU/g starch) is added and the solution is stirred for 2 to 20 hr at 70°C. Then the solution is jetcooked at 130 °C for a short time, for example 1 to 20 seconds 20 and spray dried using for example a model Compact spray dryer (Anhydro, Denmark).

Suitable starches are for example chosen from maize, wheat, barley, rice, triticale, rice, millet, tapioca, arrow root, banana, potato, sweet 25 potato starches, sago starch, or from high amylose starches like amylomaize, wrinkled pea starch, mung bean starch, and yellow pea starch. High amylose starches may be derived from naturally occurring mutant from cereal starches like high amylose corn, or peas, beans etc. or from genetically modified plant varieties such as potatoes modified to 30 preferentially produce amylose. Alternatively, the amyloamaltase-treated starch can be derived from a blend of amylose containing starches and

amylopectin rich starches like waxy maize, waxy barley, waxy wheat, waxy rice, amylopectin potato, amylopectin tapioca, amylopectin sweet potato or amylopectin banana starch. Amylopectin starches may be derived from plants that selectively produce amylopectin such as waxy cereals or 5 amylose-free potato mutants and/or genetically modified plant varieties such as potatoes and tapioca modified to selectively produce amylopectin.

As used herein, the term 'pregelatinized starch' is meant to refer to cold swelling or cold soluble starches. Pregelatinized starch (PS) can be prepared 10 according to methods well known to the artisan. Non-exclusive examples thereof are spray drying, spray cooking, drum drying, extrusion, hydrous organic solvents. These techniques can sometimes be used in conjunction with cooking techniques such batch or jet cooking. Virtually all starches can be pregelatinized. For example the starch can be chosen from maize, wheat, 15 barley, rice, triticale, rice, millet, tapioca, arrow root, banana, potato, sweet potato starches or from high amylose starches like amylo maize, wrinkled pea starch, mung bean starch. High amylose starches may be derived from a naturally occurring mutant from cereal starches like high amylose corn, or peas, beans etc. or from genetically modified plant varieties such as potatoes 20 modified to preferentially produce amylose.

In one preferred embodiment the starch is chosen from the amylopectin-rich starches like waxy maize, waxy barley, waxy wheat, waxy rice, amylopectin potato, amylopectin tapioca, amylopectin sweet potato or amylopectin banana starch. More preferably, PS is a waxy root or tuber starch, most 25 preferably waxy potato starch or waxy tapioca starch.

Amylopectin starches may be derived from plants that selectively produce amylopectin such as waxy cereals or amylose-free potato and tapioca mutants and/or genetically modified plant varieties such as potatoes and tapioca modified to selectively produce amylopectin. Alternatively, the

pregelatinized starch can be derived from a separation process as described in patent application DE928100 in combination with pregelatinizing techniques.

5 The PS for use in a method of the invention can be a native starch or a starch derivative obtained by crosslinking, esterification and/or etherification. In one embodiment, PS is a high amylopectin starch such as a commercially available native pregelatinized amylopectin potato starch from AVEBE, Veendam, The Netherlands. In another embodiment, PS is a  
10 crosslinked and stabilized high amylopectin starch such as a commercially available pregelatinized crosslinked stabilized amylopectin potato starch from AVEBE, Veendam, The Netherlands. Combinations of native and derivatized PS can also be used.

The absolute and relative amounts of ATS and PS to be added to the curd  
15 can vary. Typically, the mixture comprises ATS in an amount of 2-4.5 %, preferably 2.5-3% by weight based on the dry weight of the final product. The typical amount of PS is 1-5 %, preferably 1.5-3%, by weight based on the dry weight of the final product. Preferably, the total amount of added starch (ATS+PS) is in the range of 3-6%, more preferably 3.5-5% by weight  
20 based on the dry weight of the final product. For example, about 26 gram of ATS and about 35 gram of PS are added to 800 gram of a cut curd comprising 37-38% of non-water components.

The relative proportion of ATS to PS in a starch blend of the invention is not critical to achieve an acceptable result. For example, ATS and PS may be  
25 used in a relative weight ratio of between 95:5 and 5:95, preferably in a relative weight ratio of 10:1 to 1:10. In one aspect, ATS is used in excess of PS. Preferably, PS is used in an amount equal to or larger than the amount of ATS, for example ATS and PS may be used in a relative weight ratio of 1 : 0.5 to 1 : 2.0, preferably 1 : 0.75 to 1 : 1.5.

Known spreadable and pumpable cheese products are typically prepared by heating naturally ripened cheese with an emulsifier added thereto at an appropriate temperature. If such emulsifiers are used, this is mostly done in the form of so-called melting salts. It has to be stipulated that the melting 5 salts are not emulsifiers but they restore the emulsifying ability of the milk proteins very efficiently. (<http://www.magma.ca/~scimat/Cheese.htm>). The emulsifiers ensure that a product is obtained which is microbiologically more stable. A pasteurization step ensures that the product is microbiologically stable and does not ripen any further. The melting salts 10 prevent the cheese from turning, which means that the cheese separates into a fat fraction and a water fraction. Many employed melting salts are phosphates and citrates. A disadvantage of the use of melting salts is that they typically cause crystals and influence the pH of the spreadable cheese. Besides, it also requires labelling which is less desired as the food 15 processing industry is aiming for clean or no labelling.

It was surprisingly found that a method of the invention does not require the addition of traditional melting salts in order to obtain a spreadable cheese product having an acceptable structure and consistency, and which remains stable for at least 1 month. Apparently, the melting salts can be 20 replaced substantially or even completely by the starch blend of the invention comprising ATS and PS.

Hence, in one embodiment the mixture does not contain any additional (melting) salts.

However, a method of the invention is in no way limited to avoiding or 25 excluding melting salts, and the mixture may further comprises one or more salts, preferably sodium chloride. Other useful ingredients include one or more acids, preferably ascorbic acid or lactic acid, to lower the pH of the product, e.g. to a value of approximately 4 to 5, preferably about 4.5.

The order of adding the various ingredients to a cut curd can vary. In one embodiment, the curd and dry ingredients (starches, optionally salt(s)) are combined and heated to a temperature of about 55 to 65°C while mixing. Then, an acid such as lactic acid or ascorbic acid is added in such an amount 5 that the final pH is in the range of 4 to 5. The mixture is then heated further until a temperature of between 71 and 75°C, typically for a duration of about 1-2 minutes. Preferably, step (d) comprises heating and shearing at a temperature between 71 and 75°C. The heating may comprise the application of steam. Following heating, step (e) is performed comprising 10 cooling the mixture under stirring to obtain a cream cheese product. The resulting product can then be transferred to a suitable container and stored refrigerated.

Accordingly, the invention also provides a spreadable cheese product obtainable by a method according to the invention.

15 A further aspect relates to a composition comprising (i) a cheese curd obtained in or intended for a process for making a hard-type cheese (ii) an amylose-treated starch (ATS) and (iii) a pregelatinized starch (PS). Typically, rennet coagulated curd has a pH between 5.5 to 6.5. Such a curd is obtained through a cutting and pressing process  
20 All the preferences for starch types, starch amounts, starch ratio's and additives described herein above are applicable for a composition of the invention. In a specific embodiment, the invention provides a composition comprising a curd, amylose-treated potato starch and a pregelatinized amylopectin potato starch (native or chemically modified), optionally further 25 comprising a salt and an acid.

A composition of the invention is advantageously used in the manufacture of a spreadable cheese product.

## EXPERIMENTAL SECTION

**Example 1: Selection of useful starches.**

5 This example describes the evaluation of a number of different starches for use in the manufacture of a spreadable cheese from a Rennet coagulated cheese curd.

**Materials**

10 • Raw cow's milk was obtained from farm Bos (Zuidbroek, the Netherlands) or Schouten (Kantens, the Netherlands).

• Cheese culture, type G600.7 and rennet (Kalase, 150 IMCU) were obtained from CSK Food Enrichment (Leeuwarden, the Netherlands)

• Lactic acid ~ 90%

15 • Sodium chloride

• Calcium Chloride

• Starches used

- ATPS: Amylomaltase-treated potato starch by AVEBE.
- PAPS: pregelatinized amylopectin potato starch by AVEBE
- MAPS: non-pregelatinized crosslinked hydroxypropylated amylopectin potato starch by AVEBE
- IMAPS: pregelatinized crosslinked acetylated amylopectin potato starch by AVEBE
- MACS: non-pregelatinized crosslinked hydroxypropylated amylopectin corn starch (waxy maize) by Ingredion
- MTS: non-pregelatinized crosslinked hydroxypropylated tapioca starch by Ingredion

20

25

Curd preparation

- Raw cow's milk is pasteurized in a double jacket vessel, until a temperature of 72°C has been reached. Subsequently the milk is cooled to 35°C.
- 5 • Cheese culture (kg milk x 1.25 = grams of culture) and rennet (kg milk x 0.25 = grams of rennet) and calcium chloride are added to the pasteurized milk.
- The milk is allowed to curdle for approx. 30 minutes at 35°C. The firmness of the curd is judged by making a small cut in the curd and lifting underneath the cut. A "porcelain break" (clean cut with sharp edges) should be visible.
- 10 • When the desired firmness is reached, the curd is cut into small squares (< 1 x 1 cm). The curd is stirred for 3 minutes and left to rest for 30 minutes.
- 15 • The curd is drained, by opening a drain in the vessel (letting the whey out).
- Warm water (approx. 35°C, about half of the volume of the original amount of milk) is added to the curd. This is left to rest for 15-20 minutes. The curd is drained again by passing it over a sieve.
- 20 • The curd is placed in a container in a water bath at 35°C to culture until a pH of 5.7 is reached. The curd is stored at 4°C.

Measurements / calculations

- As whey separation from curd continues during storage, the ration between curd particles (white gummy lumps) and whey (clear yellowish liquid) is determined, to be sure to use the correct amounts each time.
- 25 • Water is added to the curd/whey mixture, to imitate steam injection which will occur in certain equipment (e.g. Stephan UM130).

- Cream can be added to the recipe, to increase the fat content of the final product. Without additional cream, the fat content is approx. 13%.
- The moisture content of the curd particles is determined by using a moisture balance at 140°C. Dry matter of the final products is 35%-45%
- Lactic acid is used to lower the pH of the spreadable cheese to approx. 4.5.
- Salt (sodium chloride) is added.

10

#### Spreadable cheese preparation

- Curd and whey (in the correct ratio) are put in the bowl of a Stephan cooker (type UM5) and mixed for 5 minutes at 2000 rpm.
- Starch additives are added in dry form and mixed for another 5 minutes at 2000 rpm.
- Using a hot water bath, the double jacket bowl of the Stephan cooker is heated. Product is mixed at 2000 RPM.
- When the mixture has reached 60°C, lactic acid is added, in such amount that the final pH of the product will be around 4.7. The mixture is further heated until the product has reached 72°C.
- The product is transferred into small sample containers and stored refrigerated.

15

20

Table 1

Starch additive	Results
None (negative reference)	Phase separation, no acceptable product
MAPS (2 to 5%)	Thick, unworkable paste during process
MACS (3.25 to 3.75%)	Thick, unworkable paste during process
MTS (3.25 to 3.50%)	Thick, unworkable paste during process
ATPS (2 to 2.5%)	Grainy, crumbly texture with no coherent cheese entity
PAPS (2 to 5%)	Thin, liquid texture, no acceptable product
ATPS (2 to 3%)+ PAPS (2 to 3%)	<b>Good consistency, good spread ability</b>
ATPS (2 to 3%) + IMAPS (1,5 to 3%)	<b>Good consistency, good spreadability</b>

In view of the results shown in Table 1, it can be concluded that a  
5 combination of an amylo-maltose-treated starch and a pregelatinized starch, is advantageously used in the manufacture of a spreadable cheese product. In contrast, amylo-maltose-treated starch alone, or the pregelatinized starch alone, or the non-pregelatinized, so-called "cook-up" starches that are typically used for creating stable structures in dairy applications, are not  
10 suitable.

**Example 2: Method for the manufacture of a spreadable cheese.**

This example describes one way of carrying out the present invention using a specific combination of starches to aid in the processing of  
15 a cheese curd intended for making a hard cheese into a spreadable cheese.

Materials & Method

Curd (from a process for hard cheese) was obtained from Cheese Farm Karwij in Rolde, The Netherlands.

800 g of curd, (37.7 % of non-water components), 25.9 g of ATPS, 34.5 g of 5 PAPS, 3.45 g of NaCl, 320 g of water and 7.05 g of ascorbic acid were placed in a high speed mixer (Thermomix). The pH was 5.15. The mixer was started at 600 rpm (speed 9). The mixture was heated until 72.5°C, which was maintained for 1 minute. The mixture was cooled with stirring and cooled until 40 °C. Then the mixture was filled in containers for 10 refrigeration. After one night the samples were tested and judged on creaminess. The resulting product was perceived as a spreadable cheese, with a good consistency and spreadability

The above experiment was essentially repeated with a curd of 35% dry 15 matter (860 g) to which was added 25.9 g of ATPS, 34.5 g of IMAPS, 3.5 g of NaCl, 7.05 g of ascorbic acid and 300 g of water. IMAPS is a pregelatinized crosslinked/stabilized amylopectin potato starch.

The result was similar to the cream cheese obtained with ATPS and PAPS described herein above, demonstrating the structuring effect of 20 amylose-treated starch in combination with either native or derivatized pregelatinized starch. In contrast, an experiment with only ATPS failed because of a grainy, crumbly, texture with no coherent cheese entity.

### Example 3: Spreadable cheese

An exemplary spreadable cheese product has the following composition

	<u>Ingredients</u>	<u>%</u>
5	Curd / whey	89.78
	Water	4.42
	PAPS	2.70
	ATPS	2.20
10	Salt	0.50
	Lactic acid	0.40

Spreadable cheese has approx. 40% solids and 13% fat.

### 15 Example 4 : Different combinations of ATS and PS

Combinations of starch additives			
PAPS (%)	ATPS (%)	Ratio ATPS / PAPS	Results
2.60	2.30	1 : 1.13	Good product, firms during shelf life, getting more crumbly
2.55	2.20	1 : 1.16	Good consistency, good spreadability
2.70	2.20	1 : 1.23	Good consistency, good spreadability
2.85	2.10	1 : 1.36	Good consistency, good spreadability, firms during shelf life
IMAPS (%)	ATPS (%)	Ratio ATPS / IMAPS	Results
1.80	2.20	1 : 0.82	Good consistency, good

			spreadability
2.30	2.20	1 : 1.05	Slightly too firm consistency, reasonable spreadability
2.70	2.20	1 : 1.23	Slightly too firm consistency, reasonable spreadability

Claims

1. A method for preparing a spreadable cheese product, comprising the steps of
  - 5 (a) coagulating wholly or partly the protein of a milk product through the action of rennet or other suitable coagulating agents;
  - (b) partially draining the whey resulting from the coagulation to obtain a cheese curd;
  - (c) preparing a mixture of the cheese curd, water, an amylosemaltose-treated starch (ATS) and a pregelatinized starch (PS);
  - 10 (d) heating and shearing the mixture at a temperature between 70 and 80°C; followed by
  - (e) cooling the mixture under stirring to obtain a spreadable cheese product.
2. Method according to claim 1, wherein the milk product is skimmed milk, partly skimmed milk, cream, whey cream or buttermilk, or any combination of these materials.
3. Method according to claim 1 or 2, wherein the milk product is obtained from cow, buffalo, goat or sheep, preferably from cow.
4. Method according to any one of the preceding claims, wherein step
  - 20 (a) comprises incubating the milk product with rennet and a food grade acidulant under conditions allowing for casein coagulation.
5. Method according to any one of the preceding claims, wherein the ATS and/or PS is derived from maize, wheat, barley, rice, triticale, rice, millet, tapioca, arrow root, banana, potato, sweet potato starches, wrinkled pea starch, mung bean starch, sago starch and yellow pea starch.

6. Method according to any one of the preceding claims, wherein the ATS is derived from a blend of amylose- containing starches and amylopectin- rich starches like waxy maize, waxy barley, waxy wheat, waxy rice, amylopectin potato, amylopectin tapioca, amylopectin sweet potato or 5 amylopectin banana starch.
7. Method according to any one of the preceding claims, wherein PS is native starch or a starch derivative obtained by crosslinking, esterification and/or etherification.
8. Method according to any one of the preceding claims, wherein PS is 10 a waxy root or tuber starch.
9. Method according to claim 8, wherein PS is a waxy potato starch or waxy tapioca starch.
10. Method according to any one of the preceding claims, wherein PS is a crosslinked and stabilized high amylopectin starch.
- 15 11. Method according to any one of claims 1-8, wherein PS is a non- crosslinked, non-stabilized high amylopectin starch.
12. Method according to any one of the preceding claims, wherein the mixture comprises ATS in an amount 2.0-4.5%, preferably 2.5-3% by weight of the mixture.
- 20 13. Method according to any one of the preceding claims, wherein the mixture comprises PS in an amount of 1.0-5.0%, preferably 1.5-3.0%, by weight of the mixture.
14. Method according to any one of the preceding claims, wherein ATS and PS are used in a relative weight ratio of 10:1 to 1:10.
- 25 15. Method according to claim 14, wherein ATS and PS are used in a relative weight ratio of 1 : 0.5 to 1 : 2.0, preferably 1 : 0.75 to 1 : 1.5.

16. Method according to any one of the preceding claims, wherein the mixture further comprises one or more salts, preferably sodium chloride, and/or one or more food grade acids, preferably ascorbic acid or lactic acid.
17. Method according to any one claims 1-15, wherein the mixture does not contain any additional melting salts.
18. Method according to any one of the preceding claims, wherein step (d) comprises heating and shearing at a temperature between 71 and 75°C.
19. Method according to any one of the preceding claims, wherein step (d) comprises the application of steam.
- 10 20. A spreadable cheese product obtainable by a method according to any one of claims 1 to 19.
21. A composition comprising (i) cheese curd obtained in a process for making a hard-type cheese, (ii) an amylose-treated starch (ATS) and (iii) a pregelatinized starch (PS).
- 15 22. Use of a composition according to claim 21 in the manufacture of a spreadable cheese product.

# INTERNATIONAL SEARCH REPORT

International application No  
PCT/NL2016/050025

**A. CLASSIFICATION OF SUBJECT MATTER**  
INV. A23C19/00 A23C19/06 A23C19/09  
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

**B. FIELDS SEARCHED**

Minimum documentation searched (classification system followed by classification symbols)  
A23C

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-Internal, BIOSIS, FSTA, WPI Data

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	GB 2 032 241 A (KRAFT INC) 8 May 1980 (1980-05-08) examples -----	1-22
A	US 5 679 396 A (FINNOCCHIARO EUGENE T [US]) 21 October 1997 (1997-10-21) column 3, lines 48-56; examples 4-8 column 6, lines 8-11 -----	1-22
A	WO 2008/071744 A2 (DSM IP ASSETS BV [NL]; BUWALDA PIETER LYKLE [NL]; SEIN ARJEN [NL]) 19 June 2008 (2008-06-19) examples 5,6 -----	1-22
A	WO 2012/080150 A1 (DSM IP ASSETS BV [NL]; SMIT-BOER KRISTINA [NL]; MEIMA HEINE ROELF [NL]) 21 June 2012 (2012-06-21) cited in the application page 4, line 14 -----	1-22



Further documents are listed in the continuation of Box C.



See patent family annex.

\* Special categories of cited documents :

- "A" document defining the general state of the art which is not considered to be of particular relevance
- "E" earlier application or patent but published on or after the international filing date
- "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- "O" document referring to an oral disclosure, use, exhibition or other means
- "P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
30 May 2016	15/06/2016
Name and mailing address of the ISA/ European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Authorized officer  Graham, Judith

# INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/NL2016/050025

Patent document cited in search report	Publication date	Patent family member(s)		Publication date
GB 2032241	A 08-05-1980	CA GB	1116010 A 2032241 A	12-01-1982 08-05-1980
US 5679396	A 21-10-1997	NONE		
WO 2008071744	A2 19-06-2008	CA CN EA EP US WO	2670249 A1 101557715 A 200900809 A1 2091341 A2 2010143542 A1 2008071744 A2	19-06-2008 14-10-2009 30-10-2009 26-08-2009 10-06-2010 19-06-2008
WO 2012080150	A1 21-06-2012	CN EA EP JP US WO	103260429 A 201300705 A1 2651244 A1 2013544530 A 2013337141 A1 2012080150 A1	21-08-2013 29-11-2013 23-10-2013 19-12-2013 19-12-2013 21-06-2012