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(54) PROCESS FOR PRODUCING A DAIRY RAW MATERIAL, USEFUL IN THE MANUFACTURE OF CHEESE

(71) We, CENTRALE LAITIERE DE HAUTE NORMANDIE, a Body Corporate organised under the laws of France, of 51, Rue Berrubé 76150 Maromme, France, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

The present invention relates to the treatment of milk by ultrafiltration for the manufacture of dairy products, e.g. cheeses. The invention finds particularly interesting application in the treatment of milk intended to be subjected to ultrafiltration to serve as a raw material for the manufacture of fresh cheses, soft cheeses, pressed cheeses, of the Saint Paulin type or similar cheeses. The invention also relates to the cheeses so obtained.

Cheese making tradition teaches that there exists a narrow relationship between the size and form of the cheese on the one hand and the characteristics which define its texture on the other hand. Apart from the fat content, and apart from the surface or internal flora, the texture of a cheese depends on the plasticity and the structure of its paste.

The plasticity and the cohesion of a paste are closely connected with its dryness and its composition, in particular with its content of alaline-earth elements—calcium and magnesium—, these characteristics varying from one type of cheese to another.

However if the calcium is a determining factor for the plasticity, slight variations therein causing substantial changes in flexibility and elasticity of the paste, its existence gives rise, in the presence of lactic acid in sufficient amount, to calcium lactate, which is a producer of bitterness.

The reduction in the level of calcium lactate in a cheese is obtained, in traditional manufacture, by two different routes, according to whether the paste must or must not be flexible, that is to say whether one has to retain much or little calcium to respond to the required criteria:

when the paste has to retain a sufficient level of calcium, there is a need to remove a maximum of lactose—i.e. potential lactic acid—by extended ripening of the curded material, by washing the latter, or by both at once.

When the paste must be further demineralised, calcium is solubilised as a result of the development of acidity consequent upon lactic fermentation, and is removed in the serum, so that the presence of lactose does not result in any drawback. The word "serum" in the present specification refers to whey (or the portion of milk remaining liquid when the rest forms curd).

Calcium is present in milk and cheese paste in various combinations—carbonate, phosphate, citrate, lactate,—and as the case may be, in the state of dissociated salt, in the state of a salt which is undissociated, although dissolved, or in the state of a complex salt with casein. The removal of calcium in the form of lactate is all the greater as the acidity of the serum is higher. In fact, the complete solubilisation of the calcium, which is manifested by identical levels of calcium in the milk and in the serum extruding from the coagulum or present in the permeate of an ultrafiltration apparatus, is only obtained at an acidity higher than that corresponds to the isoelectric point of casein, as for example at a pH of from 4.2 to 4.3 rather than at a pH of 4.7 (the isoelectric point of casein).

When the ultrafiltration of milk is carried out, the serum produced contains approximately 0.4 g/l of calcium when the milk is sweet, i.e. has not undergone prior acidification, but has a pH of 6.6 for example, whereas it has a calcium content substantially equal to that of the milk from which it is derived, namely about 1.2 g/l, if the acidity is high—pH of the order of 4.3 for example.

The process with which the invention is

concerned resorts to a certain degree of acidification, before ultrafiltration, of the whole or a fraction of the milk, according to the manufacture concerned; this acidification, as mentioned above, solubilises calcium so that it can be removed in the serum, and it may be so removed in the form of lactate.

It is an advantage of the process according to the invention that it enables the decalcification of the coagulum which takes place during draining to be replaced by a decalcification of the milk utilized, which is more reliable since it can be extremely accurate. The process eliminates those risks of a deviation from the desired properties which may be entailed by the more or less rapid development of lactic fermentation, during draining, which development governs both the calcium content and the final dryness of the cheese on emerging from the draining room.

In its general form, the invention relates therefore to a process for producing a dairy raw material, useful notably in the manufacture of cheese, said process comprisinig acidifying at least a fraction of the amount of milk required for the manufacture of the cheese concerned to a pH below the isoelectric point of casein, optionally to a pH equal to or less than 4.4, the thus acidified milk being subjected to ultrafiltration, and said process also comprising at least one step of lowering the temperature of the acidified milk or ultrafiltration retentate to a temperature between 0 and 4° C, whereby an ultrafiltration retentate constituting the desired dairy raw material is obtained which is capable of being converted into cheese by so treating it with rennet, or other equivalent coagulating enzyme, as to cause the casein to coagulate at said temperature between 0 and 4° C.

The ultrafiltration is carried out preferably until the retentate processes the desired dry extract and calcium content corresponding to the cheese to be manufactured.

According to another aspect of the invention, it embraces also, as a novel industrial product, the dairy raw material produced by the above-defined process.

It is to be noted that, according to an important preferred feature of the invention, the process may effect acidification by a lactic fermentation of the milk in the course of ultrafiltration; however, for the transformation of the present dairy raw materials into cheeses themselves, there must always be utilised an enzyme adapted to coagulate the casein of the pre-cheese.

In the sense of the present description, such an enzyme is rennet or other equivalent coagulating enzyme. The process according to the invention is well adapted to cheese under well determined conditions: a pH of the acidified milk which is below the isoelectric point of casein, and which may thus be ≤ 4.4, and a temperature of the retentate between 0 and 4° C, whereby the transformation into cheese of the retentate can be effected by renneting the latter.

Thus, the pH of the milk is brought beyond the isoelectric point of the casein, so that the calcium complexed with the latter is gradually solubilised progressively with the lowering of the pH. The thus acidified milk is subjected to ultrafiltration. If the pH has been lowered to 4.3, the ultrafiltrate contains as much calcium as the milk from which it is derived.

When the level of calcium contained in the retentate, taking into account the concentration to be reached, is judged sufficient, the ultrafiltration may be interrupted. The manufacture of fresh pastes necessitates a concentration varying from 2.5 to 4 g/l. The concentration is higher for other cheeses.

The invention takes advantage of a peculiar property of casein. The latter, in fact, is distinguished from other proteins not only by the fact that it does not coagulate under the effect of heat, but also by the fact that it is incapable of floculating at a temperature between 0 and 4° C, whatever the reaction of the medium in which it is suspended, and even if this reaction is that of its isoelectric point, which as mentioned earlier, is situated at pH 4.7.

The invention also takes advantage of another propery of casein, that of coagulating under the action of rennet, at a relatively low temperature below 4° C, for example at +2° C if the acidity is sufficiently high. It seems that the tendency not to coagulate at low temperature is annulled by the high acidity.

The process according to the invention enables the calcium content of the fabricated cheese to be adjusted accurately. This factor is of a considerable importance for the final dryness of the cheese, all things being otherwise equal, in particular the rennetting temperature, the quality and the proportion of rennet, the initial acidity of the milk used, as well as that developed consequent upon lactic fermentation, the mechanical working accompanying the molding, the temperature of the draining room and the other usual factors of cheese manufacture.

A curd ceases to drain, if it is dry extract reaches a certain value related to its calcium content. For example, a curd does not drain further even though it has a dry extract of 38%, if its calcium content is of the order of 1.8 g/kg, while a curd containing 4g/kg of calcium will continue to exude serum if it shows, for the same fat level, a

it is possible to use a milk derived from any milk-giving female animal, e.g. a cow, ewe, goat, ass or buffalo. In the same way, it is possible to resort for example to raw or pasteurised milk, to a whole milk or a wholly or partly skimmed milk, and to a previously unconcentrated or previously concentrated milk; in order to effect at the same time a reduction in the calcium content in the retentate and a reduction in the proportion of lactose with respect to the other constituents of the cheese, the retentate can be diluted with water, or with an aqueous solution, in the course of ultrafiltration. Preferably the dilution of the retentate with water or with an aqueous salt solution is effected at the end of the ultrafiltration.

The invention can include two modifications: one relying upon artificial acidification, and the other relying upon natural acidification. The latter is much preferred in practice and will hence be the only one described in the following.

For natural acidification, recourse is had to lactic fermentation to acidify all or part of the milk which is to be subjected to the ultrafiltration. This fermentation will be carried out as far as possible at a temperature close to that which is normally used in cheese technology.

It would also appear preferable, although not imperative, to use a milk having the required fat content for the manufacture of the cheese envisaged, rather than to proceed, after ultrafiltration of a skimmed milk, to mix the retentate and added cream, which, contributing fat, yields non-concentrated skimmed milk. The level of concentration to be obtained is hence lowered by resorting to a fatty milk rather than by starting from a skimmed milk whose retentate must then be enriched.

It is also observed that, where the milk used is a skimmed milk, in the case of slow coagulation (manufacture of fresh cheese), it is desirable , without this being an obligation, to effect homogenisation of the fat in the form of cream added to enrich the skimmed milk before pasteurisation so as to avoid any separation of the fat during the setting of the precheese.

The practical conditions in which the process of the invention are applied depend upon the ultrafiltration equipment available as well as on the types of cheeses to be manufactured.

When the ultrafiltration equipment permits a high speed of circulation of the milk over membranes, in particular a speed higher than 3 m/s, the ultrafiltration can be conducted at a temperature which can go up to 50° C, subject to the consequences that this can entail from the organoleptic point of view. It has been observed in fact that the heating of flocculated casein has practically no effect on the fluidification of the retentate, which here has to be carried out subsequently, i.e. when the ultrafiltration has terminated.

In equipment with a high speed of circulation, the ultrafiltration yield obtained with milk previously coagulated by acidification is very satisfactory. This must be attributed probably to the fact that, in the coagulated milk, the serum is already separate from the floculated casein, so that the separation of the constituents of the milk by ultrafiltration is effected more easily.

If the only ultrafilteration modules available permit no more than a moderate flow speed, in particular below 3 m/s, or if the concentration must be considerable and the viscosity of the retentate would become too high for equipment with a high flow speed, excessive pressures would develop on the membranes; in these circumstances, the fluidification of the milk utilised or of the very viscous retentate is obligatory before or in the course of ultrafiltration rather than after the completion of ultrafiltration, as will be described below in more detail.

To obtain satisfactory yields, it is preferable to conduct the ultrafiltration of the coagulated milk up to its termination and only to fluidise the retentate subsequently. This preferred embodiment of the invention will now be illustrated in its application to the manufacture of fresh cheeses and soft cheese.

In order to obtain fresh cheeses, the process is characterised:

in that the milk used is coagulated by lactic fermentation, at the usual temperature in this field, generally from 16 to 18° C, until the production of an acidity at least equal to 90 degree Dornic, for a pH close to 4.3,

in that the milk thus coagulated is ultrafiltered at a temperature below or equal to the renneting temperature but above 4° C, said temperature being able to be between 10 and 12° C, the ultrafiltration being conducted until the retentate has the desired dry extract, corresponding to the cheeses to be manufactured,

in that the retentate thus obtained is fluidised by cooling it, protected from air, to avoid any foam formation, at a temperature between 0 and 4° C, for example 2° C,

in that rennet is added to the thus cooled retentate or pre-cheese, the addition being carried out at a temperature between 0 and 4° C,

and in that the thus renneted precheese is then left to warm up gradually, once the setting of the latter has commenced.

As has been previously indicated, it is preferable to start with a milk having a fat content corresponding substantially to the richness that the manufacturer proposes to

have in the cheese. It can be also be advantageous here to homogenise the fat in the form of cream before adding it to the milk. The conditions under which the ultrafiltration is carried out are similar to those which have already described in the specialised literature. The dairymen, skilled in the art, hence possess all the necessary bibliographical references in this respect. Reference may be made to recent works of F. Kosikowski "Cheese and fermented milk foods", Edward Brothers USA, Second edition (1977) and R. MADSEN "Hyperfiltration and ultrafiltration in plate-and-frame systems" (1977). It has been observed according to the invention that ultrafiltration of the coagulated milk works under extremely satisfactory conditions and with a high yield in ultrafiltration equipment with a high speed of circulation.

The fluidification of the retentate is produced by cooling, for example to a temperature of 2° C, while effecting stirring of said retentate, protected from air, in order to avoid foam formation.

It should be noted that once the renneting has been carried out and setting commenced, the temperature to which the pre-cheese is brought after coagulation, conditions the firmness of the curd and the "body of the fresh paste". These operations are carried out either in closed molds whose shape and size correspond to those of the desired cheese, or in bulk if one is dealing with a fresh paste to be subsequently packaged in conventional manner.

Once the setting has ended, the finishing operations are carried out in accordance with traditional techniques. If the fresh paste has been placed in a mold, unmolding of the cheeses follows, and they are next salted, and then successively placed in the cheese drying room and in the cellar, to await their development, as is practiced currently for the manufacture of the cheeses known as Neufchatel, Olivet and Dreux, and similar fresh cheeses. Where fresh pastes in bulk are concerned, it suffices to stir the curd to obtain a fine and unctuous paste before packaging in accordance with known technology to obtain (among others) Swiss, demi-Swiss, demi-sel cheeses, diet cheese, herb cheeses, and cream heart cheeses.

According to a modification, the process according to the invention also enables fresh cheeses to be obtained which will keep for a long time. According to such an embodiment, after ultrafiltration of the coagulated milk, the retentate is subjected to a treatment, called ultrahigh temperature (UHT) treatment, in the course of which it is brought to a temperature of 140° C to 150° C for a period of the order of seconds, for example for 1 second, after which the thus heat-treated retentate is immediately homogenised and cooled to 70° C, as is already practised in equipment which enables UHT sterilisation of milk to be carried out. However, in the case of the invention, the cooling is continued so that the retentate finally reaches a temperature between 0 and 4° C, in particular 2° C. Of course, all these operations must be carried out under fully aseptic conditions.

Due to the cooling which is carried out in accordance with the teachings of the present invention, the casein is deflocculated and occurs in the retentate in the suspended state. The homogenised retentate is cooled, admixed with sterile rennet, for example, in the proportion of 10 to 20 ml per hundred liters of retentate, and then conditioned aseptically in sterile commercial packages. The dairy raw material thus obtained by the invention constitutes a trrue pre-cheese, conditioned between 0 and 4° C, for example at 2° C This pre-cheese is kept in a cooled container for a sufficient time for the rennet to exert its coagulating effect and convert it into cheese. The hardening will be developed when the cheese has returned to ordinary temperature.

The unctuous and fine texture of the paste will be obtainable by shaking the commercial containers holding the cheese either by the cheese maker at the end of manufacture or by the consumer, at the time of use.

It is another object of the invention to provide a process for producing cheese using a milk ultrafiltration retentate, wherein a first ultrafiltration retentate is prepared starting from normal milk and a second ultrafiltration retentate is prepared starting from milk acidified to a pH below the isoelectric point of casein, the casein then occurring in a flocculated state in said second retentate, the amount of acidified milk representing a fraction of the total amount of the milk required for the manufacture of the cheese concerned, and the amount of normal milk representing the complement of the total amount; the first and the second retentate are mixed in proportions corresponding to the characteristics of the final cheese to be manufactured, thus giving a precheese; the precheese is cooled to a temperature between 0 and 4° C, which has the effect of resuspending the flocculated casein of the second retentate and thus rendering it subsequently coagulable under the effect of rennet or an equivalent coagulating enzyme; the precheese, after having been allowed to warm up, is treated with an enzyme capable of coagulating the casein; and the desired cheese is then produced therefrom by conventional means of the art according to the type of the cheese.

Such a process can be advantageously used for the manufacture of soft cheeses,

pressed cheeses, of the Saint Paulin type, or similar cheeses.

The amount of acid retentate to be incorporated in the mixture will be lower for cheeses of the Saint Paulin type than for cheeses of the Camembert type.

For the manufacture of soft cheeses, for example, only a part of the amount of the milk which is required for the manufactore of the cheeses concerned is acidified. Two retentates are thus prepared: one resulting from the ultrafiltration of a sweet milk (i.e. milk which has not undergone prior acidification) and the other obtained by the ultrafiltration of the same milk but previously acidified by lactic fermentation. Then, in suitable proportions and at a temperature between 0 and 4° C, the two retentates obtained are mixed, to obtain a precheese having the characteristics corresponding to those of the cheese to be manufactured. The raw material resulting from mixing the two retentates is renneted at a temperature not involving lactic flocculation of the casein, generally slightly below the conventional temperature.

Then the precheese is run into closed molds and, once setting has occurred, the cheeses are unmolded in traditional manner.

Thus, as has been previously indicated, it is advantageous to start from a milk having the required fat content corresponding to that of the soft cheese which has to be manufactured.

The first retentate derived from ultrafiltration of the milk which has not been subjected to prior acidification, has a maximum calcium content. It is possible, as has been mentioned in the preamble, to subject it to a more or less extensive delactosing step by diluting the retentate before the end of the ultrafiltration operation. The second retentate, obtained after ultrafiltration of the same milk previously acidified by lactic fermentation, e.g. to a pH in the vicinity of 4.3, has a reduced calcium content. It should be recalled that prior lactic fermentation of the milk is carried out at a temperature in the vicinity of that of the milk utilised in traditional cheese manufacture.

The mixing of the two above defined retentates must be done in suitable proportions to obtain a precheese possessing the characteristics corresponding to those of the type of cheese which has to be manufactured.

The principal factors which should be adjusted, apart from the fat content which is fixed by that of the milk utilised, are dryness at the end of draining, as well as the richness in calcium and magnesium of the final cheese. For example, for a Camembert paste, a 38 to 68% dry extract should be obtained for a final calcium content of 1.8 to 2g per kilogram.

In general, if delactosing of the first retentate is not practised, one part of this retentate resulting from the ultrafiltration of sweet (i.e. unacidified) milk is used for 2 to 3 parts of the retentate obtained by ultrafiltration of the same milk previously acidified by lactic fermentation. The proportions to be retained depend also on the concentration level of each of the two retentates.

The mixture of the two retentates is then cooled to a temperature between 0 and 4° C. The floculated casein of the acid retentate is resuspended and regains its coagulability as a result of the action of the rennet; this deflocculation is regarded as an essential characteristic of the invention. The fluidised mixture naturally has an acid reaction which varies according to the proportion of the two retentates. In the case of cheeses of the Camembert type, the pH of the mixture will generally vary between 4.9 and 5.0.

To manufacture cheeses from a dairy raw material produced by a process according to the invention, it suffices to rennet this material after heating to a temperature compatible with the casein, generally below the usual renneting temperature. The operations of running into molds, molding, setting, unmolding and the like are carried out according to traditional cheese making practice.

It has also been noted that a milk acidified by lactic fermentation—generally up to 90° Dornic—and then subjected, under normal conditions, to ultrafiltration is exceptionally unsusceptible to contamination, whether the ultrafiltration temperature is less than 4° C or reaches 30 or 40° C (as it may do notwithstanding the cooling to between 0 and 4° C specified herein). This property is very advantaageous from the hygiene point of view in the course of the application of the process of the invention.

The present invention will be illustrated without being limited in any way by the following examples.

EXAMPLE 1

A test on fatty milk was carried out with a pilot plant including eight membranes disposed in series, these being 8 cylindrical ABCOR membranes each measuring 25 mm in diameter and 1500 mm in length, and the apparatus being supplied by a gear pump for recycling the retentate, operating at a maximum flow rate of 4800 l/h.

The test may be summarised as follows:

(a) — milk utilised:

initial volume	...	100 l
fat-free dry extract	...	93 g/l
fat content	... ...	36.6 g/l

calcium content ... 1.28 g/l
acidity (degrees Dornic) 92° D
pH 4.30

duration: 14 hours

temperature of the milk maintained during the operation: 12° C.

(b) — operation of ultrafilrtation:

serum:	time (hours)	volume passed through	dry extract	nitrogeous material	calcium content	pH
	1	8.5 l	63 g/l	2.3 g/l	1.16 g/l	4.32
	2	16.5 l	63 g/l	2.3 g/l	1.18 g/l	
	3	23.5 l			1.18 g/l	
	4	28.8 l			1.20 g/l	
	9	47.6 l				
	10	50.8 l				
	11	53.3 l				
	12	55.6 l				
	13	57.7 l				
	14	59.7 l	61 g/l	2.2 g/l	1.22 g/l	4.35

retentate:

dry extract	23.5%
fat to dry material	38.8%
calcium content	1.08 g/l

It is to be understood that this retentate was cooled to between 0 and 4°C. before renneting.

EXAMPLE 2

A test similar to example 1 was carried out in order to prepare cheeses of the Neufchatel type, the packages having a height of 60 mm and a diameter of 45 mm.

This test was on 200 l of milk having

a fat free extract of	94.0 g/l
a fat content of	43 g/l
calcium content of	1.20 g/l
pH, after lactic acidification of	4.52

The same ultrafiltration module as previously used, the membranes being however combined in a different way—4×2 instead of 1×8—, the module operating at a temperature of 20° C to bring the concentration of the milk from its initial value to 3.3 times its initial value, and then at 4° C to bring this concentration from 3.3 to 4.3 times its initial value; this was followed by renneting at 2° C, in the proportion of 40 ml of rennet, in a strength of 1/15,000, to 100 litres, before distribution, into closed molds, of a precheese having the following characteristics:

dry extract	39.4%
fat to dry material ...	49.2%
calcium content ...	0.88 g/l

The results obtained in Examples 1 and 2 provided fresh cheeses having organoleptic qualities comparable in all respects to those of similar cheeses manufactured by a conventional cheese making procedure.

EXAMPLE 3

Tests were carried out with the same ABCOR module mentioned in Examples 1 and 2, but with its 8 membranes arranged differently, viz. in four pairs of 2 membranes, i.e. 4×2. The module was connected to a gear pump capable of a flow rate of 13,000 l/h.

In a typical test, which lasted more than 24 h, 175 litres of milk, previously acidified by lactic fermentation, and containing 44 g/l of fat, were brought to a quarter of the initial volume; the ultrafiltration was carried out at 28° C to a concentration of 3.2, then, to terminate, to a quarter of the initial volume at a temperature in the vicinity of 4° C. This was done in order to fluidise the retentate and thus maintain a pressure acceptable for the membranes, viz. less than 5 bars.

The ultrafiltration being terminated, the retentate of the acidified milk—pH 4.33, was mixed with a retentate of the same un-acidified milk—pH 6.54—previously obtained by concentration to a fifth on the same ultrafiltration module, in the proportion of 2.9 litres of acid retentate per 1.1 litres of the retentate derived from the unacidified milk.

The pre-cheese thus obtained had the following characteristics:

dry extract	39.1%
fat to dry matter ...	48.3%
calcium content ...	1.8 g/l
pH	4.96

After being stirred and brought for a sufficient time to 2° C to ensure complete deflocculation of the casein, the precheese was reheated to 25° C and, after the addition of rennet in a strength of 1/15,000 in the proportion of 40 ml per 100 litres, it was distributed in molds having the sizes of Camemberts, where it coagulated.

The Camembert cheeses thus obtained had excellent organoleptic properties.

WHAT WE CLAIM IS:—

1. Process for producing a dairy raw material, useful notably in the manufacture of cheeses, said process comprising acidifying at least a fraction of the amount of milk required for the manufacture of the cheese concerned to a pH below the isoelectric point of casein, optionally to a pH equal to or less than 4.4, the thus acidified milk being subjected to ultrafiltration, and said process also comprising at least one step of lowering the temperature of the acidified milk or ultrafiltration retentate to a temperature between 0 and 4° C, whereby an ultrafiltration retentate constituting the desired dairy raw material is obtained which is capable of being converted into cheese by so treating it with rennet, or other equivalent coagulating enzyme, as to coagulate the casein at said temperature between 0 and 4 C.

2. Process according to claim 1, wherein the milk used is derived from a cow, ewe, goat, ass, buffalo, or other dairy female.

3. Process according to claim 1 or 2, wherein the milk used is a raw or pasteurised milk, is a whole milk or a wholly or partly skimmed milk, and is a previously unconcentrated or previously concentrated milk.

4. Process according to any preceding claim, wherein, in order to effect at the same time a reduction in the calcium content in the retentate and a reduction in the proportion of lactose with respect to the other constituents of the cheese, the retentate is diluted with water or with an aqueous solution, in the course of ultrafiltration.

5. Process according to claim 4, wherein the dilution of the retentate with water or with an aqueous salt solution is effected at the end of the ultrafiltration.

6. Process according to any preceding claim, wherein the milk is acidified by lactic fermentation.

7. Process according to claim 6, wherein said acidification is done at a temperature of from 16 to 18° C.

8. Process according to any preceding claim, wherein a milk is used having the fat content required for the manufacture of the cheese envisaged, no step being included whereby, after ultrafiltration of a skimmed milk, the retentate is mixed with added cream.

9. Process according to any preceding claim, wherein the milk used is a skinned milk, and wherein, in particular for the manufacture of soft cheese, homogenisation of fat in the form of cream added to enrich the skimmed milk before pasteurisation is carried out so as to avoid any separation of the fat during the setting of the precheese.

10. Process according to any preceding claim, wherein the ultrafiltration is carried out by circulating the milk over membranes at high speeds, particularly at a speed above 3m/s, and wherein the temperature of the milk in circulation is up to 50 degrees C.

11. Process according to any one of claims 1 to 9, wherein the pultrafiltration of the coagulated milk is carried out until its completion and the retentate is only later fluidised by cooling to a temperature between 0 and 4° C.

12. Process according to any preceding claim, wherein in order to manufacture fresh cheese, the milk used is coagulated by lactic fermentation at the usual temperature in this field, generally from 16 to 18° C, until the production of an acidity at least equal to 90 degrees Dornic, for a pH in the vicinity of 4.3,

the thus coagulated milk is ultrafiltered at a temperature of below or equal to the renneting temperature but above 4° C, which temperature can be situated between 10 and 12° C, the ultrafiltration being conducted until the retentate has the desired dry extract, corresponding to the cheese to be manufactured,

the retentate thus obtained is fluidised by cooling it, protected from air, to avoid any foam formation, at a temperature between 0 and 4° C, for example 2° C,

rennet is added to the retentate or precheese thus cooled, the addition being carried out at a temperature between 0 and 4° C, and

the precheese thus renneted is allowed, once the setting of the latter has commenced, to reheat gradually.

13. Process according to any of claims 1 to 11, wherein after ultrafiltration of the coagulated milk, the retentate is subjected to ultrahigh temperature (UHT) treatment in the course of which it is brought to a temperature of 140 to 150° C for a period of the order of seconds, for example for 1 second, after which the thus heat-treated retentate is immediately homogenised and cooled to 70° C, the cooling being continued so that the retentate reaches finally a temperature of between 0 and 4° C, in particular 2° C, after which, the homogenised and

cooled retentate is admixed with rennet and then conditioned in sealed packages, the raw dairy material thus obtained being conditioned between 0 and 4° C, for example at 2° C.

14. Process for producing cheese using a milk ultrafiltration retentate, wherein a first ultrafiltration retentate is prepared starting from normal milk and a second ultrafiltration retentate is prepared starting from milk acidified to a pH below the isoelectric point of casein, the casein then occurring in a flocculated state in said second retentate, the amount of acidified milk representing a fraction of the total amount of milk required for the manufacture of the cheese concerned, and the amount of normal milk representing the complement of this total amount; the first and the second retentate are mixed in proportions corresponding to the characteristics of the final cheese to be manufactured, thus giving a precheese; the precheese is cooled to a temperature between 0 and 4° C, which has the effect of resuspending the flocculated casein of the second retentate and thus rendering it subsequently coagulable under the effect of rennet or an equivalent coagulating enzyme; the precheese, after having been allowed to warm up, is treated with an enzyme capable of coagulating the casein; and the desired cheese is then produced therefrom by conventional means of the art, according to the type of cheese.

15. Process according to any preceding claim, being a process leading to a soft cheese, comprising acidifying only a part of the amount of milk which is required for the manufacture of the cheese concerned, and, to this end, comprising:

preparing two retentates, one resulting from the ultrafiltration of an unacidified milk, and the other obtained by ultrafiltration of the same milk, but acidified previously by lactic fermentation,

then mixing, in suitable proportions and at a temperature between 0 and 4° C, the two retentates obtained above to obtain a precheese having the characteristics corresponding to those of the cheese to be manufactured,

renneting the raw material resulting from mixing the retentates,

heating the mixture to a temperature generally slightly below the conventional temperature, and thereafter

running the precheese into closed molds, from which once setting has taken place, the cheeses are unmolded in traditional manner.

16. Process according to claim 14 or 15, wherein that milk which is acidified is acidified by lactic fermentation to a pH in the vicinity of 4.3.

17. Process according to any one of claims 14 to 16, wherein, to manufacture cheese of the Camembert type, one part of the retentate resulting from the ultrafiltration of the normal (i.e. unacidified) milk is used for 2 to 3 parts of the retentate obtained by ultrafiltration of the same milk previously acidified by lactic fermentation.

18. A as a novel industrial product, a dairy raw material for the manufacture of cheese, as obtained by a process according to any one of the preceding claims 1 to 11.

19. Dairy raw material according to claim 18, derived from an untrafiltration retentate of milk coagulated by acidification, this retenate having been subjected to UHT treatment and then cooled to a temperature between 0 and 4° C.

20. Cheese obtained as a product of a process according to any one of claims 12 to 17, or obtained from a diary raw material according to claim 18 or 19.

21. Process for the production of a dairy raw material substantially as hereinbefore described, with reference to the Examples.

22. As a new product, a dairy raw material substantially as hereinbefore described, with reference to the Examples.

23. Cheese obtained as a product of a process according to claim 21, or obtained from a dairy raw material according to claim 22.

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