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DESCRIPTION

Field of the invention

[0001] The invention relates to a milk-based product enriched with whey protein and a method for the preparation thereof.

Background of the invention

[0002] It has been shown that the whey proteins are excellent protein sources, i.a. in nutrition of athletes, in increase and maintenance of muscle mass. Therefore, there are lots of whey protein powders, and beverages produced thereof in the market. In general, as a raw material for said whey protein products, a whey protein concentrate as a powder is used which is prepared by ultrafiltration of cheese, quark, or casein whey and by subsequent drying of the concentrate received from the ultrafiltration. These products have a problem that the taste is foul which results from proteolysis caused by starters such as cheese starters and a rennet, oxidation of residual fat, and other taste flaws. Also, removal of minerals during the production process of the whey products gives rise to a taste which is more watery than that of normal milk. It has been tried to eliminate the problems associated with the taste, whereby the whey products have been flavored up with various food additives, flavoring substances, flavoring preparations and processing aids.

[0003] In addition to the taste problems of the current whey protein products, there is a problem that all the whey proteins are not equal in their nutritive value. For example, nutritive value of glycomacropeptide released from casein into whey during the cheese production is minor than those of α -lactalbumin and β -lactoglobulin. Glycomacropeptide constitutes a significant portion of the total proteins of cheese whey.

[0004] Still a further problem arises from the high content of lactose included in the known whey products. As it is commonly known, lactose causes intolerance symptoms for a large amount of adult people in the world.

[0005] It is also generally known that thermal treatment of the whey protein based product causes structural faults in the product. These products are typically described as flaky, coarse, lumpy, or sandy.

[0006] In view of the above problems, price-quality ratio of the known whey protein products is not attractive. Consequently, the products are not commonly available in large scale but are provided for consumers as specialty products obtainable in restricted facilities, like fitness centers.

[0007] Milk-based whey protein products are generally widely known. Also, various membrane techniques and combinations thereof for separating milk components into individual fractions are largely described in the literature. For example, WO 94/13148 discloses a process for producing an undenatured whey protein concentrate by means of microfiltration and ultrafiltration of skim milk. Casein is retained in the microfiltration retentate while α -lactalbumin and β -lactoglobulin penetrate the microfiltration membrane having a pore size of about 0.1 microns quite easily.

[0008] WO 96/08155 discloses a separation of casein and whey proteins from a skim milk starting material utilizing microfiltration and ultrafiltration. For example, a milk beverage with a lowered whey protein content can be produced by the process.

[0009] WO 00/30461 discloses that microfiltration can be utilized in the preparation of infant formula to make the amino acid composition similar to that of human milk.

[0010] WO 03/094623 A1 discloses that several membrane techniques, i.e. ultrafiltration, nanofiltration and reverse osmosis, are utilized to prepare a lactose-free milk beverage.

[0011] It is desirable to provide whey protein products that do not possess the drawbacks of the known products but have a pleasant taste and favorable nutritive composition.

Brief description of the invention

[0012] We have surprisingly found that the problems associated with the known whey products can be avoided by including casein in the milk-based whey protein fraction prepared by membrane techniques and enriched with α -lactalbumin and β -lactoglobulin. It is surprising that even a small amount of casein is sufficient to improve the organoleptic properties of the product, like maintain the taste as smooth and velvety. Surprisingly, also the structure and stability of the whey protein product of the invention is good without any sand, flake, deposition or gel formation etc. Also, the nutritive value of the product is increased.

[0013] In an embodiment of the invention, it is possible to prepare a whey protein beverage that looks and tastes like milk but has a composition which is more favorable to athletes and other exercise enthusiasts.

Brief description of the drawings

[0014] Fig. 1 illustrates an embodiment of the method of the invention for producing a whey protein product.

Detailed description of the invention

[0015] It is disclosed (not part of the invention) a whey protein product having a ratio of whey protein to casein in the range from about 90:10 to about 50:50 and the total protein content of at least 20% on dry matter basis. An object of the invention is to provide a whey protein product as defined in claim 1. In an embodiment of the invention, the ratio of whey protein to casein ranges from about 80:20 to about 60:40. In a specific embodiment of the invention, said ratio is about 80:20.

[0016] In a further embodiment of the disclosure, (not part of the invention), the total protein content of the product ranges from 30% to 60% on dry matter basis. In the invention, the total protein content is 40% to 60% on dry matter basis.

[0017] The whey protein product of the invention has good organoleptic properties and, specifically, is free from off-tastes caused by glycomacropolypeptides and the unpleasant metabolites present in conventional cheese, curd and casein whey. In addition, the whey protein product of the invention possesses favorable nutritive characteristics and favourable effect on health. Also, the stability of the whey protein product of the invention is good where no flakiness, settling, gelling or other phenomena causing undesirable changes in the structure is observed.

[0018] In the context of the present invention, the whey protein product means a milk-based protein product containing whey protein and casein. The whey protein product can be prepared from one or more various components obtained from milk raw material by various membrane techniques or a combination thereof. The whey protein product can further comprise minerals of milk origin. The milk raw material can be milk as such or as a concentrate or pretreated as a desired manner. The milk raw material may be supplemented with ingredients generally used in the preparation of milk products, such as fat, protein or sugar fractions. The milk raw material may thus be, for instance, full-fat milk, cream, low-fat milk or skim milk, ultrafiltered milk, diafiltered milk, microfiltered milk, lactose-free or low-lactose milk, protease treated milk, recombined milk from milk powder, organic milk or a combination of these, or a dilution of any of these. Milk can originate from a cow, sheep, goat, camel, horse or any other animal producing milk suitable for nourishment. The milk is preferably low-fat or skim milk. In a more preferred embodiment of the invention, the whey protein product is prepared from skim milk.

[0019] The whey protein product of the disclosure (not part of the invention) can be provided as a liquid, like a beverage, a concentrate or a powder. In the invention, the whey protein product is a beverage. The beverage has a typical total protein content of 2.5% to 8% by weight based on the weight of the beverage, preferably 3.5% to 6%. The casein constitutes 5% to 50%, preferably 15% to 25% of the total protein content while the whey protein enriched with α -lactalbumin and β -lactoglobulin constitutes 50% to 95%, preferably 75% to 85%.

[0020] It is characteristic of the whey protein product of the invention that it contains no sugar,

sweeteners or flavorings, however without limiting to this embodiment. In a specific embodiment of the invention, where the whey protein product is a beverage ready for instant use, no sugar, sweetener or flavoring is included in the beverage.

[0021] Like the mineral composition of cow's milk, the mineral composition of the whey protein product of the invention is highly physiological. For example, a whey protein beverage of the invention can typically contain 0.5% to 1.5%, preferably 0.6% to 0.8% of minerals. However, the calcium content of the whey protein product of the invention is lower than that of normal milk. The whey protein product can thus be provided with supplementary calcium and other milk minerals, for example, a nanofiltration permeate received from the process of the invention described below. Supplementary calcium can thus be provided as any calcium source, like milk calcium, calcium gluconate, calcium citrate, calcium lactate etc., or mixtures thereof.

[0022] Also fat can be included in the whey protein of the invention. The fat content of the product typically ranges from about 0% up to 3.5%.

[0023] In an embodiment of the invention, the whey protein product is low-lactose or lactose-free. The low lactose or lactose-free product can be achieved by membrane techniques used for the preparation of the product. Also, any residual lactose in the whey protein product can be hydrolyzed by means of an enzyme. In the context of the invention, 'low lactose' means a lactose content of less than 1% in the whey protein product. 'Lactose free' means that the lactose content of the whey protein product is 0.5 g/serving (e.g. for liquid milks 0.5 g/244 g, the lactose content being at most 0.21%), however not more than 0.5%. In accordance with the invention, whey protein beverages containing little carbohydrate and having flawless organoleptic characteristics may also be produced.

[0024] The whey protein product of the invention can be used as a raw material in the preparation of all kinds of sour milk products and/or acidified fresh products, typically yoghurt, fermented milk, viili and fermented cream, sour cream, quark, butter milk, kefir, dairy shot drinks, and other sour milk products. We surprisingly found that the organoleptic properties of the sour milk products prepared from the whey protein product of the invention are similar to those of conventional sour milk products.

[0025] The products of the disclosure (not part of the invention) may be selected from, but are not limited to, the group consisting of food products, animal feed, nutritional products, food supplements, food ingredients, health food and pharmaceutical products. An embodiment of the invention, is the use of the whey protein product in a food or feed or functional food, i.e. food having any health promoting and/or disease preventing and/or alleviating properties. The form of each of the food product, food material, and/or the pharmaceutical products, and the animal feed is not particularly limited.

[0026] As stated above, due to its favorable nutritive composition the whey protein product of the invention is suitable for athletes and other exercise enthusiasts as such or as a part of a

regular diet. The present invention provides a composition comprising whey protein for supporting and improving healthy eating. The product of the disclosure (not part of the invention) can also be useful especially in connection for alleviation and/or prevention of adult-onset diabetes, metabolic syndrome and sarcopenia.

[0027] Another object of the invention is to provide a use of the whey protein product as a food product, animal feed, nutritional product, food supplement, food ingredient and health food. In an embodiment of the invention, the product is provided as a functional food and/or a nutritional product. In an embodiment of the disclosure, (not part of the invention), the product is provided as a pharmaceutical.

[0028] The whey protein product is produced from one or more of the fractions obtained by means of membrane techniques. Two or more techniques can be combined, including microfiltration, ultrafiltration, nanofiltration, and reverse osmosis, in an appropriate manner. It is disclosed (not part of the invention), a method for producing a whey protein product which comprises

- subjecting a milk-based raw material to microfiltration to separate an ideal whey as a microfiltration permeate and a casein concentrate as a microfiltration retentate,
- subjecting at least a portion of the microfiltration permeate to ultrafiltration to provide an ultrafiltration permeate and a whey protein concentrate as an ultrafiltration retentate,
- composing a whey protein product from the ultrafiltration retentate and a casein-containing material so as to provide a ratio of whey protein to casein in the range of about 90:10 to about 50:50 and a total protein content of at least 20% on dry matter basis, and if desired, from other ingredients.

[0029] An object of the invention is to provide a method for producing a whey protein product as defined in claim 4.

[0030] The milk-based raw material is preferably skim milk.

[0031] In an embodiment of the invention, the casein-containing material is the microfiltration retentate obtained in the method of the invention. In another embodiment, the casein-containing material is milk. As used herein, the term "milk" means any normal secretion obtained from the mammary glands of mammals, such as cow's, goat's, camel's, horse's or sheep's milk, or any other animal producing milk suitable for nourishment. The milk can be supplemented with ingredients generally used in the preparation of milk products, such as fat, protein or sugar fractions, or the like. The milk thus include, for example, full-fat milk, low-fat milk or skim milk, cream, ultrafiltered milk (UF retentate), diafiltered milk, microfiltered milk (MF permeate), milk recombined from milk powder, organic milk or a combination or dilution of any of these.

[0032] In an embodiment, the milk is skim milk. In another embodiment, the milk is low lactose

or lactose-free milk.

[0033] After composing the whey protein product, it can be heat treated as a manner known per se, if appropriate.

[0034] In an embodiment of the invention, at least a portion of the ultrafiltration permeate including majority of the minerals and sugars including lactose can further be subjected to nanofiltration (NF) to separate minerals into a NF permeate and sugars to NF retentate. In another embodiment, at least a portion of the NF permeate can be still further be subjected to reverse osmosis (RO) to concentrate the minerals into a RO retentate. These fractions obtained from said further membrane filtrations can be utilized to compose a whey protein product of the invention. In an embodiment of the invention, a microfiltration retentate, ultrafiltration retentate and nanofiltration permeate are used in the preparation of the whey protein product of the invention. In another embodiment of the invention, a microfiltration retentate, ultrafiltration retentate and reverse osmosis retentate are used in the preparation of the whey protein product of the invention.

[0035] In a further embodiment of the invention, microfiltration (MF), ultrafiltration (UF) and/or nanofiltration (NF) are enhanced by diafiltration using water or a suitable fraction obtained from the membrane filtrations. When diafiltration is associated with microfiltration, an UF permeate obtained from the ultrafiltration of the MF permeate is suitably used as diawater. When the UF permeate is further subjected to nanofiltration, a NF permeate is suitably used as diawater in the ultrafiltration. When the NF permeate is still further subjected to reverse osmosis (RO), an RO permeate is suitably used as diawater in the nanofiltration. One or more of said diafiltration steps can be used in the process of the invention.

[0036] The method of the invention provides a whey protein product having good organoleptic properties, like taste and mouth-feel, with good stability. It is possible, by means of the method, to prevent the release of glycomacropptides and metabolites causing unpleasant off-tastes for the whey protein product. It is thus possible to reduce, eliminate or mask the off-tastes of the whey protein product by performing the method of the invention.

[0037] The previous studies show that there are differences in nutritive quality of the whey proteins. More particularly, it has been discovered that α -lactalbumin has a more favorable nutritive value than β -lactoglobulin. Based on this knowledge, the composition of the whey protein product of the invention can be adjusted to various uses in an appropriate manner. In the present invention, the adjustment of the whey protein composition is achieved by a heat treatment of milk raw material, or by a selection of a membrane. The process of the invention uses a technique known per se in the heat treatment of milk products. Examples of heat treatments to be used in the process of the invention are pasteurization, high pasteurization, or heating at a temperature lower than the pasteurization temperature for a sufficiently long time. Specifically, UHT treatment (e.g. milk at 138°C, 2 to 4 s), ESL treatment (e.g. milk at 130°C, 1 to 2 s), pasteurization (e.g. milk at 72°C, 15 s), or high pasteurization (95°C, 5 min) can be mentioned. The heat treatment may be either direct (vapour to milk, milk to vapour) or indirect

(tube heat exchanger, plate heat exchanger, scraped-surface heat exchanger).

[0038] In an embodiment of the invention, milk is subjected to a heat treatment at a temperature range of 65°C to 95°C, for 15 seconds to 10 minutes prior to microfiltration to selectively separate the whey protein ingredients. As a result from the heat treatment, β -lactoglobulin is denaturated and associated with casein while α -lactalbumin passes through a membrane. In this way the content of the α -lactalbumin can be increased in the microfiltration permeate.

[0039] In an embodiment of the invention, lactose in the whey protein product of the invention in the milk raw material is hydrolyzed into monosaccharides as is well known in the field. This can be performed with commercially available lactase enzymes in a manner known per se. In an embodiment of the invention, the lactose hydrolysis is realized after the membrane filtrations on the composed whey protein product. In another embodiment of the invention, the lactose hydrolysis step and microfiltration step are initiated simultaneously with each other. In still another embodiment of the invention, the lactose hydrolysis of the milk raw material is initiated prior to membrane filtration step.

[0040] The lactose hydrolysis can continue as long as the lactase enzyme is inactivated, for example by a heat treatment of a whey protein product composed at a later stage of various fractions received in the method of the invention (UF retentate and MF retentate).

[0041] The following examples are presented for further illustration of the invention without limiting the invention thereto.

Example 1

[0042] Skim milk (1 000 L) is microfiltered by polymeric filtration membranes (Synder FR) having a pore size of 800 kDa. The concentration factor of 95 is used, including a diafiltration step. The concentration factor is calculated by Equation 1. The amount of microfiltration retentate formed is 190 L having a dry matter content of 20.0%.

$$\text{concentration factor (-)} = \left(\frac{\text{feed (L)}}{\text{retentate (L)}} \right) \times \left(\frac{\text{diafiltration feed (L)}}{\text{diafiltration retentate (L)}} \right) \quad (1)$$

[0043] The permeate formed in the microfiltration (1 890 L) is further filtered by polymeric ultrafiltration (UF) membranes (Koch HFK-131) having a pore size of 10 kDa. The permeate obtained from the ultrafiltration is further subjected to nanofiltration (NF) to give a NF retentate and permeate (130 L).

[0044] Ultrafiltration is performed by means of diafiltration using 130 L of the NF permeate above as diawater. The total concentration factor of the ultrafiltration is 24 (Equation 1). In the

ultrafiltration, 100 L of ultrafiltration retentate and 1 920 L of ultrafiltration permeate are formed, of which 1 080 L is used for the diafiltration of the microfiltration. The remaining ultrafiltration permeate (840 L) is nanofiltered by filtration membranes (Desal 5-DK) having a cut-off value of 200 Da. The concentration factor of the nanofiltration is 4.25 (Equation 1), whereby 197 L of nanofiltration retentate and 644 L of nanofiltration permeate are formed, 130 L of the latter being used as diawater in the diafiltration of the ultrafiltration of the microfiltration permeate, as described above.

[0045] The residual nanofiltration permeate not used as diawater in the diafiltration of the ultrafiltration of the microfiltration permeate is used for other purposes or concentrated by reverse osmosis membranes (Koch HR) by using a concentration factor of 10 (Equation 1). The amount of reverse osmosis permeate of the nanofiltration permeate formed is 500 L, of which 44 L is used as diawater in the diafiltration of the nanofiltration. The amount of reverse osmosis retentate of the nanofiltration permeate formed is 55 L.

Example 2

[0046] Skim milk (1 000 L) is subjected to a heat treatment at a temperature range of 65°C to 95°C, for 15 seconds to 10 minutes in a heat treatment apparatus to selectively separate the whey protein ingredients. The heat treatment of the skim milk influences the permeation of whey proteins in the microfiltration so that the microfiltration permeate is enriched with α -lactalbumin that is less thermolabile having denaturation degree of 0 to 26% while β -lactoglobulin is denaturated to a degree of 1 to 90%. After the heat treatment of the skim milk, the milk is subjected to the filtration procedures as described in Example 1.

[0047] As an example, the proportion of α -lactalbumin of the total amount of α -lactalbumin and β -lactoglobulin (% by weight) in the microfiltration permeate was 38% (heat treatment of 75°C for 30 seconds) to 45% (heat treatment of 90°C for 30 seconds).

Example 3

[0048] A whey protein product according to the invention was composed from the microfiltration retentate and ultrafiltration retentate of Example 1 as shown in Table 1. The whey protein to casein ratio of the product was 80:20 and the protein content was 58% on the dry matter basis. The product was a low lactose milk drink in which the lactose was hydrolyzed enzymatically after composing.

[0049] An educated expert panel evaluated the product organoleptically. The organoleptic properties were 'very good'. No taste flaws or structural faults affecting mouth-feel were observed.

Table 1

	MF retentate	UF retentate	Product 80:20 low lactose
Portion (%)	9	91	100
Protein (%)	15.3	5.8	6.6
Whey protein (%)	0.05	5.8	5.3
Casein (%)	15.2	0	1.4
Lactose (%)	4.2	3.9	<1
Ash (%)	3.6	0.5	0.8

Example 4

[0050] A whey protein product according to the invention was composed from the microfiltration retentate, ultrafiltration retentate and nanofiltration retentate of Example 1, and water as shown in Table 2. The whey protein to casein ratio of the product was 80:20 and the protein content was 43% on the dry matter basis.

[0051] An educated expert panel evaluated the product organoleptically. The organoleptic properties were 'very good'. No taste flaws or structural faults affecting mouth-feel were observed.

Table 2

	MF retentate	UF retentate	NF retentate	Milk mineral powder	Water	Product 80:20
Portion (%)	5.2	55	12	0.2	27	100
Protein (%)	15.3	5.8	0	0	0	4.0
Whey protein (%)	0.05	5.8	0	0	0	3.2
Casein (%)	15.2	0	0	0	0	0.8
Lactose (%)	4.2	3.9	17.5	45	0	4.7
Ash (%)	3.6	0.5	1.1	41	0.08	0.7

Reference Example 5

[0052] A whey protein product was composed from the microfiltration retentate, ultrafiltration retentate, nanofiltration retentate and nanofiltration permeate of Example 1 as shown in Table 3. The whey protein to casein ratio of the product was 60:40 and the protein content was 38% on dry matter basis.

[0053] An educated expert panel evaluated the product organoleptically. The organoleptic properties were 'very good'. No taste flaws or structural faults affecting mouth-feel were observed.

Table 3

	MF retentate	UF retentate	NF retentate	NF permeate	Product 60:40
Portion (%)	8.7	34	17	40	100
Protein (%)	15.3	5.8	0	0	3.3
Whey protein (%)	0.05	5.8	0	0	2.0
Casein (%)	15.2	0	0	0	1.3
Lactose (%)	4.2	3.9	17.5	0.08	4.7
Ash (%)	3.6	0.5	1.1	0.2	0.8

Example 6

[0054] A whey protein product according to the invention was composed from the microfiltration retentate, ultrafiltration retentate, nanofiltration retentate of Example 1, milk mineral powder and water as shown in Table 4. The whey protein to casein ratio was 50:50 and protein content was 48% on the dry matter basis. The product was a lactose-free milk drink in which the lactose was hydrolyzed enzymatically to a level of less than 0.1% after composing.

[0055] An educated expert panel evaluated the product organoleptically. The organoleptic properties were 'very good'. No taste flaws or structural faults affecting mouth-feel were observed.

Table 4

	MF retentate	UF retentate	NF retentate	Milk mineral powder	Water	Product 50:50 lactose-free
Portion (%)	11	28	7.2	0.1	53	100
Protein (%)	15.3	5.8	0	0	0	3.3
Whey protein (%)	0.05	5.8	0	0	0	1.6
Casein (%)	15.2	0	0	0	0	1.6
Lactose	4.2	3.9	17.5	45	0	<0.1

	MF retentate	UF retentate	NF retentate	Milk mineral powder	Water	Product 50:50 lactose-free
(%)						
Ash (%)	3.6	0.5	1.1	41	0.08	0.7

Example 7

[0056] A whey protein product according to the invention was composed from the microfiltration retentate, ultrafiltration retentate, nanofiltration retentate and reverse osmosis retentate of Example 1, and water as shown in Table 5. The whey protein to casein ratio of the product was 70:30 and its protein content was 51% on the dry matter basis. The product was a lactose-free milk drink in which the lactose was hydrolyzed enzymatically to a level of less than 0.1% after composing.

[0057] An educated expert panel evaluated the product organoleptically. The organoleptic properties were 'very good'. No taste flaws or structural faults affecting mouth-feel were observed.

Table 5

	MF retentate	UF retentate	NF retentate	RO retentate	Water	Product 70:30 lactose-free
Portion (%)	7.9	48	4.4	4.4	53	100
Protein (%)	15.3	5.8	0	0	0	4.0
Whey protein (%)	0.05	5.8	0	0	0	2.8
Casein (%)	15.2	0	0	0	0	1.2
Lactose (%)	4.2	3.9	17.5	0.8	0	<0.1
Ash (%)	3.6	0.5	1.1	2.3	0.08	0.7

Example 8

[0058] A whey protein product according to the invention was composed from milk and the ultrafiltration retentate of Example 1 as shown in Table 6. The whey protein to casein ratio of the product was 70:30 and the protein content was 48% on the dry matter basis.

[0059] An educated expert panel evaluated the product organoleptically. The organoleptic properties were 'very good'. No taste flaws or structural faults affecting mouth-feel were

observed.

Table 6

	Milk	UF retentate	Product 70:30
Portion (%)	50	50	
Protein (%)	3.4	5.8	4.6
Whey protein (%)	0.6	5.8	3.2
Casein (%)	2.8	0	1.4
Lactose (%)	4.7	3.9	4.3
Ash (%)	0.8	0.5	0.6

REFERENCES CITED IN THE DESCRIPTION

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Patentkrav

1. Valleproteinprodukt der har et forhold mellem valleprotein og kasein i området fra 80:20 til 50:50, et totalt proteinindhold på 40 % til 60 % på tørvægtsbasis og et proteinindhold på 2,5 til 8 vægtprocent baseret på vægten af produktet, hvor produktet er en drikkevare og hvor produktet er fremstillet med en fremgangsmåde omfattende

10 - at udsætte et mælkebaseret råmateriale for mikrofiltrering for at separere en ideel valle som et mikrofiltreringspermeat og et kaseinkoncentrat som et mikrofiltreringsretentat,

- at udsætte mindst en del af mikrofiltreringspermeatet for ultrafiltrering for at tilvejebringe et ultrafiltreringspermeat og et valleproteinkoncentrat som et ultrafiltreringsretentat,

15 - at danne et valleproteinprodukt fra ultrafiltreringsretentatet og et kaseinindeholdende materiale for således at tilvejebringe nævnte valleproteinprodukt.

2. Valleproteinproduktet ifølge krav 1, hvor forholdet mellem valleprotein og kasein er i området fra 80:20 til 60:40, fortrinsvis omkring 80:20.

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3. Valleproteinproduktet ifølge krav 1 eller krav 2, hvor produktet yderligere omfatter supplerende mælkemineraler.

4. Fremgangsmåde til fremstilling af et valleproteinprodukt, hvilken omfatter

25 - at udsætte et mælkebaseret råmateriale for mikrofiltrering for at separere en ideel valle som et mikrofiltreringspermeat og et kaseinkoncentrat som et mikrofiltreringsretentat,

30 - at udsætte mindst en del af mikrofiltreringspermeatet for ultrafiltrering for at tilvejebringe et ultrafiltreringspermeat og et valleproteinkoncentrat som et ultrafiltreringsretentat,

- at danne et valleproteinprodukt fra ultrafiltreringsretentatet og et kaseinindeholdende materiale for således at tilvejebringe et forhold mellem

valleprotein og kasein i forholdet af 80:20 til 50:50, et totalt proteinindhold på 40 % til 60 % på tørvægtsbasis, og et proteinindhold på 2,5 til 8 vægtprocent baseret på vægten af produktet, hvor valleproteinproduktet er en drikkevare.

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5. Fremgangsmåden ifølge krav 4, hvor det kaseinindeholdende materiale er mikrofiltreringsretentatet.

6. Fremgangsmåden ifølge krav 4, hvor det kaseinindeholdende materiale er mælk.

7. Fremgangsmåden ifølge et hvilket som helst af kravene 4 til 6, hvor det mælkebaserede råmateriale er skummetmælk.

8. Fremgangsmåden ifølge et hvilket som helst af kravene 4 til 7, hvor ultrafiltreringspermeatet udsættes for nanofiltrering for at tilvejebringe et nanofiltreringsretentat og -permeat.

9. Fremgangsmåden ifølge krav 8, hvor nanofiltreringspermeatet udsættes for omvendt osmose for at tilvejebringe et omvendt osmose-retentat og -permeat.

10. Fremgangsmåden ifølge et hvilket som helst af kravene 4 til 9, hvor diafiltrering anvendes med mikrofiltrering, ultrafiltrering og nanofiltrering.

11. Fremgangsmåden ifølge et hvilket som helst af kravene 4 til 10, hvor mikrofiltreringsretentatet, ultrafiltreringsretentatet og nanofiltreringspermeatet anvendes til at danne valleproteinproduktet.

12. Fremgangsmåden ifølge et hvilket som helst af kravene 4 til 10, hvor mikrofiltreringsretentatet, ultrafiltreringsretentatet og omvendt osmose-retentatet anvendes til at danne valleproteinproduktet.

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- 13.** Fremgangsmåden ifølge et hvilket som helst af kravene 4 til 12, hvor mælkeråmaterialet udsættes for en varmebehandling ved et temperaturområde fra 65 °C til 95 °C i 15 sekunder til 10 minutter forud for mikrofiltrering.
- 5 **14.** Fremgangsmåden ifølge et hvilket som helst af kravene 4 til 13, hvor frigivelsen af glycomakropeptider i valleproteinproduktet forhindres.
- 15.** Fremgangsmåden ifølge et hvilket som helst af kravene 4 til 14, hvor dannelsen af ubehagelige metabolitter i et valleproteinprodukt forhindres.
- 10
- 16.** Fremgangsmåden ifølge et hvilket som helst af kravene 4 til 15, hvor bismagen af valleproteinproduktet reduceres, elimineres eller maskeres.
- 17.** Anvendelse af valleproteinproduktet ifølge et hvilket som helst af kravene 1 til 15 3 eller fremstillet med en fremgangsmåde ifølge et hvilket som helst af kravene 4 til 16 for anvendelse som et fødevareprodukt, dyrefoder, næringsprodukt, fødevarer supplement, fødevarer ingrediens og helsekost.
- 18.** Anvendelsen ifølge krav 17, hvor valleproteinproduktet er en funktionel 20 fødevare.
- 19.** Anvendelse af valleproteinproduktet ifølge et hvilket som helst af kravene 1 til 3 eller fremstillet med en fremgangsmåde ifølge et hvilket som helst af kravene 4 til 16 i fremstillingen af surmælksprodukter og/eller forsurede friskprodukter, 25 såsom yoghurt, fermenteret mælk, viili, fermenteret fløde, creme fraiche, kvark, kærnemælk, kefir og mejerishotdrikkevarer (*dairy shot drinks*).

DRAWINGS

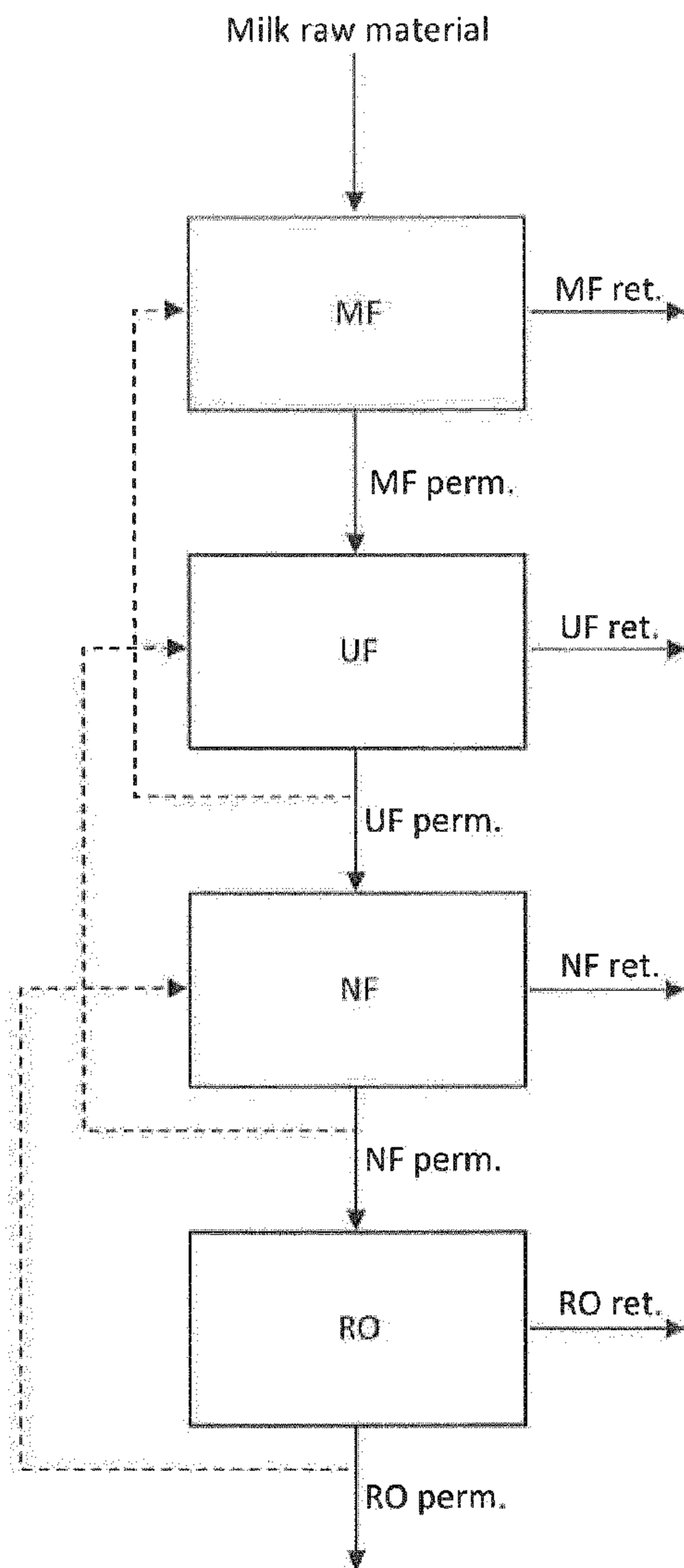


Fig. 1