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A process for the preparation of colostrum

The present invention is related to a process for the preparation of essentially bacteria-free colostrum.

Colostrum, or first milk, is the breast milk which is
5 secreted by mammals during the last part of pregnancy and the first few days after parturition. Colostrum contains a little less fat than the later milk and is rich in proteins, especially immunoglobulins. Colostrum possess a number of outstanding and interesting properties, a.o. owing to the high
10 nutritional value. The proteins in colostrum, and especially immunoglobulins, have a wide range of uses.

Bovine colostrum may also contain a high number of bacteria, about 10^6 - 10^8 bacteria/ml. However, problems have been present for a long time relating to methods to reduce the
15 bacteria content in colostrum for thereby to be able to produce a bacteria-free colostrum composition.

Heat sterilization (pasteurisation) of colostrum to remove the bacteria is not possible because heating will denature and coagulate the proteins (this is especially
20 important in relation to biologically active proteins).

A common prior art method for sterilizing solutions is microfiltration. However, microfiltration of colostrum has not been possible so far, because the casein in colostrum immediately clogs the microfilters and makes the filtration
25 impossible (see German Patent C 2 813 984).

PCT Application WO 85/10192 describes a nutritional drink based on colostrum. This product was sterilized, after separation of the fat from the colostrum with a conventional method, by removing the casein by precipitation (with hydrochloric acid) followed by microfiltration of the resulting
30 "whey".

US Patent No. 5 147 548 describes preparation of a sterile-filtered colostrum with a retained casein content. According to the method of this publication a defatted
35 colostrum solution is acidified with hydrochloric acid until the casein precipitates at a pH of 4-5 and then returns to solution by lowering of the pH to 2-3.5. Then, the colostrum solution can be microfiltered and the pH of the solution is subsequently returned to the original value by adding NaOH.



Thus, such a method requires, in addition to the micro-filtration, two additional steps which make the procedure for the preparation of bacteria-free colostrum more complicated and far more expensive. In addition, product obtained by this method is not a "natural" colostrum, owing to the addition of an acid, followed by a base, which results in a higher salt content than in "natural" colostrum. It is also an open question whether these additions of acids and alkali will effect and change the natural proteins in colostrum (especially the valuable immunoglobulins).

By the present invention it was surprisingly discovered a process by which, after the fat had been removed, natural colostrum, including the casein, could be micro-filtrated. This process provides a colostrum composition wherein the bacteria content is reduced up to 99.9 %, and otherwise wherein all the natural components, besides fat, are retained without application of any additives or complicating and demanding supplementary treatments. All the previously preformed attempts in the prior art of directly micro-filtration of defatted colostrum have been unsuccessful, and in US 5 147 548, column 1, it is concluded that: "Filtration sterilization, the simplest and most effective method of eliminating the bacteria and the method that protects the proteins, cannot be employed with colostrum because the casein immediately clogs up the filter".

By the present invention it was surprisingly discovered that colostrum can be microfiltrated by using a larger booster pump and increasing the velocity of the concentrate.

In a common microfiltration of milk the booster pump rate (the milk which flows through filter) is 6 m³/hour. In microfiltration of colostrum the filter will clog up at this rate.

By the present invention it was surprisingly discovered that colostrum can be microfiltrated by using a larger booster pump and increasing the velocity of concentrate to between 7.2 and 7.8 m³/hour.

Thus, the present invention provides a process for microfiltration of natural, defatted colostrum for the

preparation of an essentially bacteria free (99.9 %) colostrum wherein the original components (especially the protein composition) are retained in essentially native form and without any use of additives.

Thus, the process of the present invention for the preparation of essentially bacteria free colostrum comprises:

Defatted colostrum is pored into a balance tank; subsequently the concentrate is transported to a booster pump by means of the feeding pump; the booster pump circulates the concentrate across a membrane wherein the pressure difference in the membrane will provide filtration of the concentrate; the concentrate flows across a heating/cooling equipment to maintain a constant operating temperature prior to returning to the booster pump; the filtrated colostrum (filtrate) circulates across the filter to maintain a constant trans-membrane pressure; the filtrate is drained on the filtrate side of the filter without reduction of pressure.

The process of the present invention is illustrated by the following, non-limiting, example, and Figure 1, which is a schematic drawing of a non-limiting example of a micro-filtration device used in the microfiltration process of the invention.

Example

Microfiltration of colostrum

In this experiment 40 kg defatted, frozen colostrum was used.

Filtration plant:	Mino MF-plant (dead volume about 7 kg)
Filtration membrane:	SCT ceramic membrane
	Pore size: 1.4 μ
	Membrane area: 0,2 m ²

The frozen colostrum was heated to 50 °C and micro-filtrated.

Samples from different steps of the process were analyzed. In the following table operating data from an experiment of microfiltration of colostrum are shown.

Table 1
Process data for microfiltration of colostrum

Time	°C	Feed P1 Bar	Concentrate in P2 Bar	Filtrate in P3 Bar	Filtrate out P4 Bar	Concentrate out P5 Bar	Concentrate Brix	Filtrate Brix	Concentrate Loop Flow M ³ /h	Concentrate Flow L/h	Filtrate Loop Flow M ³ /h
Start 13.43											
13.50	56,0	2.7	5.80	4.50	2.40	3.10	11.00	8.00	7.33	450.00	1.56
14.00	56,0	2.7	5.70	4.50	2.40	3.00	11.00	10.00	7.33	432.00	1.55
14.18	63,0	2.7	5.80	4.50	2.40	3.00	11.00	10.00	7.40	432.00	1.58
14.45	53,0	2.7	5.80	4.50	2.40	3.00	11.60	10.50	7.20	480.00	1.54
15.00	51,0	2,7	5.80	4.50	2.40	3.00	11.10	10.00	7.20	468.00	1.56
15.15	52,0	2,7	5.80	4.50	2.40	3.00	11.00	9.50	7.20	450.00	1.55
15.35	54,0	2,7	5.80	4.50	2.40	3.00	12.00	11.00	7.20	432.00	1.56
stop 16.00											

Explanation of the table:

Time: Assay time point

°C: Temperature of the product during the process

Feed P1 Bar: Feeding pump pressure

Concentrate in P2 Bar: Pressure of the concentrate (product prior to filtration) before entering the filter

Filtrate in P3 Bar: Pressure of the filtrate (product after filtration) before entering the filter

Concentrate out P5 Bar: Concentrate procedure after leaving the filter

Filtrate out P4 Bar: Filtrate procedure after leaving the filter

Concentrate Brix: Solid content in the product prior to filtration

Filtrate Brix: Solid content in the product after filtration

Concentrate Loop flow m³/h: Product rate upon entering the filter

Concentrate flow L/h: Rate of the concentrate returning to the balance tank

Filtrate Loop flow m³/h: Rate of the filtrate circulating upon entering the filter

Table 2 below shows analysis results from samples from the microfiltrated colostrum regarding microbe content, antibody content and dry matter content.

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Table 2
Microfiltrated colostrum
Microbiology (embedding in agar), antibody and dry matter content

Sample, incubated at 37°C for 1-2 days	2 days Total kim/ml	Dilution	1 day Coli /ml	Dilution	Dry matter g/30ml	mg anti- body /ml	Comments
Sample 1: Batch 1 (after microfilt.)	0		0		27,8		
Sample 2: Batch 2 --" --	0		0		28,2		
Sample 3: Batch 3 --" --	0		0		27,2	43,0	Average of batch
Sample 4: Batch 4 --" --	0		0		26,2		
Sample 5: Batch 5 --" --	0		0		27,2		
Sample 6: Batch 6 (before microfilt.)	1,07:10 ⁵	1:1000	10	1:10	30,4	50,0	

Standards:

Positive control: Bovine IgG

Negative control: Filtrate

P a t e n t c l a i m s

1. A process for the preparation of an essentially
bacteria-free colostrum by means of microfiltration, which
5 process comprises that defatted, natural colostrum (first
milk) is pored into a balance tank; subsequently the feeding
pump is pumping the concentrate to a booster pump; the booster
pump circulates the concentrate across a filter membrane
wherein the pressure difference in the membrane rendered
10 filtration of the concentrate possible; the concentrate is
flowing across a heating/cooling unit to keep a constant
process temperature before the concentrate returns to the
booster pump; filtrated colostrum (the filtrate) circulate
across the filter membrane to keep a constant transmembrane
15 pressure; the filtrate is drained without pressure loss on the
filtrate side of the filter.

2. Process according to claim 1, wherein the filter
membrane is a ceramic membrane.

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3. Process according to claim 1, wherein the bacteria
content in colostrum is reduced by up to 99.9 %.

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