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(54) Title: MILK WITH KNOWN FROTHING CHARACTERISTICS

(57) Abstract: Barista milk with predefined and well-known frothing characteristics. The milk proteins in the barista milk solely comes from the milk’s natural, original protein content. The concentration of the milk protein is regulated by filtration, e.g. ultrafiltration of raw milk. The protein content is for example more than 3.0 percent and less than 4.8 percent. The milk is sterilized by heat treatment at for example 72 degree Celcius. Barista milk is used for production of milk foam used in the making of cappuccino and other coffee drinks.
Milk with known frothing characteristics

The invention concerns barista milk for production of milk protein foam. This milk protein foam is used among other things for making a cappuccino.

State of the art
Barista milk is already known, which functionally is optimized to produce the milk protein foam, which characterizes a long range of drinks, based on espresso coffee such as cappuccino, cafe latte, macchiato, latte macchiato, cafe macchiato, cortado and cafe au lait. In the following this foam type will be characterized as 'cappuccino foam', as all the other espresso based milk coffee drinks can be prepared as variations to 'cappuccino foam' and as such can be characterized as a special type of cappuccino foam.

However, ordinary milk, including known barista milk, has several disadvantages. The two main disadvantages are that the concentration of the milk protein can vary considerably from time to time and that the barista milk in connection with the production has been exposed to considerably quality deteriorations.

The informed content of milk protein in milk and in all known milk products, including barista milk, is solely annual average approximate estimates, which cover a very large distribution (3 to 3.8 percentage), which partly is dependent of the time of the year, partly of the feed that the cows eat.

Some milk products, including barista milk, are completely or partly disinfected by heat treatment. The heat treatment can be by high pasteurization or as a UHT-treatment

High pasteurized milk is heated up to 85°C in about 20 seconds and the UHT treated milk is heated up to 140°C in 3-6 seconds. But already at the heating of milk over 75°C the whey in the milk begins to be denaturized, by which sulphur atoms disengage from the whey proteins and surface
proteins from the milk's natural fat membranes with a following significant after-taste (of rice pudding).

Another essential reduction in the quality is the addition of a foreign protein. The proteins can be whey proteins from milk from other cows or vegetable proteins.

Addition of protein is technically a fine solution, as this systematically addition of protein lifts the variation interval up to a level, where even the lowest values in the variation interval are lifted up into an area, where the milk is frothing well. The disadvantage of adding a foreign protein to the barista milk is that baristas and their customers go after the highest possible gourmet level and they consider addition of protein to be 'unnatural' and therefore undesirable.

Furthermore are milk, which has had protein added, is not thought of as real milk and must therefore not be named as such. The same condition is commonly known for another diary product, namely butter. Butter, which has been added a fatty substance, is thought of as a mixed product, which is not allowed to be called butter.

Generally, frothing milk protein is prepared in gourmet circles by using an Espresso machine, where pure water steam under pressure introduces over heated water steam and atmospheric air in to the milk through a nozzle.

Quite technically the introduction of atmospheric air in to the barista milk is done by holding the tip of the steam nozzle at the milk surface; because, while the tip of the steam nozzle is at the milk surface, the steam from the steam nozzle pushes the milk in front of it, while the atmospheric air is introduced into the milk along the sides of tip of the steam nozzle.

Both the stability, the size of the bubbles and the speed, with which the bubbles are made, depends of the protein concentration.
Surrounding the produced bubbles a bubble stabilization film is formed. The stability of the formed film is very dependent on the protein concentration. A stable foam, built of stable bubbles, both on micro level and macro level is obtained, if the stability of the film in the bubbles generally is high. The high stability on micro level has the consequence, that the bubbles only very slowly burst and 'melt' together with other bubbles, and if this process are slow the foam happens to be creamy for a longer period of time, in contrast to the airy and no-creamy experience you have with foam with big bubbles. A big film stability on the macro level is obtained from barista foam with a high protein content and is characterized by a slowly removal of the total foam volume, corresponding to a big half-life for the volume of the foam after the drink has been produced.

For the customer this means that the foam in a cappuccino produced from high quality foam remain creamy for a long time and that the foam does not disappear quickly after it has been served.

The cafe business has up through the nineties increasingly begun to focus on improving the quality of the espresso based drinks, and this has resulted in establishing worldwide competitions in exactly this discipline. In this competition culture and in the elite cafes around the World, there has been developed quite precise principles and techniques to producing a 'good cappuccino foam', which too forms the frame of reference for this production.

Obtaining of good, stable results assumes, however, that the barista milk has known frothing characteristics. But because of the varying content of milk protein in the milk, it can be difficult for the untrained barista to produce a satisfying frothing milk protein foam of high quality with low quality variation. A low content of protein can make it impossible for even trained baristas to produce a satisfying milk protein foam, and this is well-known for trained baristas, and it is referred by them to the variation in
seasons in the milk and to the fact that cows are let out on grass fields in the springtime.

Baristas, professional producers of espresso coffee, have therefore a big need for barista milk with known, well-defined frothing characteristics, that do not vary from time to time, and to be guaranteed a certain protein level in the milk.

The profit for quality products is usually considerably higher than for products produced of low-quality goods, because the manual effort is the same, and because the expense to the manual effort is the main cost in serving a drink from an espresso machine in a coffee-bar.

To be able to keep high prices and quality-conscious customers it is therefore of great importance for a coffee-bar that the customer gets an optimal taste experience every time there are served drinks from the espresso machine. The builded customer trust can suffer severely, if a newly hired employee with no skills is not taught very quickly how to make an optimal frothing of the barista milk. Another serious, unlucky situation can arise, if even a skilled barista cannot make a decent foam because of missing protein in the milk. Among other things in such situations it is of great importance that the used barista milk has a well-known and a well-defined frothing qualities by virtue of standardized contents of protein in the milk.

Therefore the barista milk with a well-known and a well-defined frothing qualities increase the guarantee that the customer each time is served a quality product regardless of the barista is a beginner or skilled person - and by this it is ensured that quality-conscious customers are satisfied or stay satisfied.

Coffee bars has therefore a great need for barista milk with a well-known and a well-defined frothing qualities.
It has been shown that when a barista is introduced to the general frothing procedure, which is common in gourmet circles, and the variable parameters, including temperature, pressure, volume and others are known and used, it is possible for unskilled staff, very quickly, to obtain the perfect result for producing cappuccino foam. But it has, however, turned up that barista milk with a well-known and a well-defined frothing quality only can be obtained, assuming that the protein concentration is kept within very narrow intervals.

It is, however, only known to produce barista milk, where the frothing characteristics are well-defined and known in advance, by adjusting the contents of protein by the help of an addition of foreign proteins or by heat treatment of the milk, so that the whey proteins denature, so that they stabilize the foam. The last mentioned has, however, the disadvantage side-effect that there is developed sulphur compound in the milk, which makes it smell of 'porridge'. Jf. such as barista milk from Arla in Sweden, to which both are added protein together with heat treatment, with denature as a result:

http://www3.arla.se/Default17767.aspx?SelectedMenuItem=21162

Milk with predetermined frothing characteristics according to the invention is characterized by the fact that the protein in the milk foam that can be produced by frothing the milk, entirely comes from the milk's natural, original contents of proteins and that the concentration of the natural protein contents - and the corresponding frothing characteristics - solely is being regulated by filtration. Preferably utilizing an ultra-filtering membrane, as stated in claim 2.

In considering that a barista by the frothing process can produce the Micro bubble texture, the natural milk must, according to the invention - as stated in the claims 3 to 5, preferably have a protein contents of more than
3.0 percent, preferably have a protein content of less than 4.8 percent and most preferably have a protein content of more than 3.0 percent and less than 4.8 percent.

To be able to reproduce the frothing process, the variation of the protein contents - as stated in claim 6 and 7, have a deviation of ± 0.20 percent at more preferably have a deviation of ± 0.10 percent and most preferably have a deviation of ± 0.05 percent.

Barista milk can according to the invention be sterilized by as stated in the claims no. 8 to 10 heat the barista milk to a temperature of under 75 degrees Celsius, preferably over 70 degrees Celsius most preferably to a temperature of 72 degrees Celsius in 15 seconds; as one at 72 degrees Celsius, 99 percent of all bacterium, fungus and spores in the milk get killed without damaging (denature) the proteins in the milk, so that the milk keeps the natural taste.

Beyond the mentioned advantages baristas and coffee bars can obtain by using natural milk according to the invention, this very invention further in addition results in essential advantages for diaries, as diaries at least can obtain 4 essential advantages by producing natural milk with predefined frothing characteristics according to the invention.

The 4 advantages are respectively:

1) that the natural milk may be sold as milk,
2) that standard diary equipment can be used,
3) that there is no need for storage or purchase of protein, and that
4) the by-product can be used as diet supplement for such as pigs.

Ad to advantage no. 1:
Cow milk, to which there has been added protein, nor if it is milk protein from cows, may carry the name, milk. Milk, to which there has been added
milk protein for example, is understood as a mixed product and shall therefore be described as a milk product. Whereas the natural milk according to the invention may as a rule be described as milk, because the procedure for producing this milk solely bring about an concentration of the milk protein in the skim milk.

Ad to advantage no. 2:
In the procedure the standard equipment, which already is to be found in most diaries, can be used, as the production of the natural milk, with a predefined protein contents only imply the equipment, which traditionally is to be used in producing yogurt.

Ad to advantage no. 3:
In particular for small diaries it is an advantage that there is no need for buying and storing protein for standardizing the protein contents in the natural milk according to the invention. Furthermore will an adjustment of the protein contents cause an extra working procedure and therefore a further expense for the diary.

Ad to advantage no. 4:
In the production of the invention, a by-product is produced, which among other things can be used as a diet supplement for pigs.

Embodiment of the invention

1000 liter skim milk with a protein percent of 3,4 was used as feed in a filter plant with an ultra-filter membrane, Alfa Laval GR70PP 6338/30, with a feed pressure of 3 bar and at a temperature of 8 degrees Celsius. The filtration was carried out such as the retained fraction, the retentate, had a protein concentration of 5 percent.

This filtration resulted in that 700 liter retentate and 300 liter permeate was produced. The retentate was used as natural protein enriched milk in producing cappuccino foam.
500 ml milk with a protein concentration of 5 percent produced as above mentioned, according to the invention, was poured into a steel jug with a capacity of 1000 milliliter. (The jug must preferably be half full to obtain the optimal dynamic during the steaming of the milk). A Dalla Corte Super Mini espresso machine was used, where the steam pressure was shown on a manometer. The steam pressure was measured to 1,5 bar dropping to 1,3 bar, when the steam was let out of the kettle in connection with the executed frothing process.

The actual frothing process passes off in two steps. At the first step the mouth of the steam nozzle is held at the surface of the milk and at the second step the mouth of the steam nozzle is held down into the frothing milk.

At the frothing of the milk the temperature of the milk were measured three places in the process for hereby being able to reproduce the frothing process.

By frothing of the milk the milk temperature were measured respectively immediately before the frothing process, at the change of the placing of the mouth of the steam nozzle from the surface to under the surface of the frothing milk and at the end of the frothing process.

The start temperature of the milk was measured to 4 degrees Celsius.

The mouth of the steam nozzle was kept at the surface of the milk until the temperature of the milk was 35 degrees Celsius. Hereafter the mouth of the steam nozzle was kept down into the frothy milk until the milk obtained a temperature of 65 degrees Celsius, after which the frothing process was stopped.

At the beginning of the frothing process, where the mouth of the steam nozzle was kept at the surface of the milk, atmospheric air was drawn down
into the milk, as the atmospheric air was drawn down by the overheated steam into the milk at the mouth of the steam nozzle.

During the first part of the frothing process, where there is a big intake of atmospheric air into the milk, mainly big bubbles are formed. In the second part of the frothing process, there is no intake of atmospheric air, therefore causes the massive intake of overheated water-steam that larger bubbles all the time are broken down into smaller bubbles, when they passes the jet-stream of overheated steam at the mouth of the steam nozzle.

The air intake increased the total volume of the milk, at the same time as the air intake was heated, which further increased the volume of the milk. To this increase in volume must be added the volume of the condensed water steam, which is condensed, when it hits the milk. The volume of the condensed water steam was measured to the total of 58 milliliter (corresponding to an increase in volume of 12 percent).

When the temperature was 65 degrees Celsius the frothing process was stopped, and a Micro bubble texture, as it is named in Barista circles, was formed. Micro bubble texture, which is characterized by very small bubbles, which guarantees a ‘creamy’ experience, when you drink the foam, and which is absolutely necessary, if you are to make patterns on the top of a cappuccino, which is one among several features, which characterizes a quality product, produced by a barista.
CLAIMS

1. Barista milk with predefined frothing characteristics
c h a r a c t e r i z e d b y
that the protein in the milk foam, which can be produced by
frothing the milk, solely comes from the milk's natural, original
contents of proteins
and
that the concentration of the natural protein contents solely is
regulated by filtering.

2. Barista milk according to claim l c h a r a c t e r i z e d b y that a ultra-
filter membrane is used at the filtering.

3. Barista milk according to claim l c h a r a c t e r i z e d b y that the
protein contents is of more than 3,0 percent.

4. Barista milk according to claim l c h a r a c t e r i z e d b y that the
protein contents is less than 4,8 percent.

5. Barista milk according to claim l c h a r a c t e r i z e d b y that the
protein contents is of more than 3,0 percent and less than 4,8 percent.

6. Barista milk according to one of the previous claims
 c h a r a c t e r i z e d b y that the indicated protein contents is mainly inside
an interval of ± 0,20 percent more preferably inside an interval of ± 0,10
percent.

7. Barista milk according to one of the of the previous claims
 c h a r a c t e r i z e d b y that the indicated protein contents is mainly inside
an interval of ± 0,05 %.

8. Barista milk according to one of the previous claims
characterized by that the heat treatment of the milk is executed at temperatures of under 75 degrees Celsius.

9. Barista milk according to one of the previous claims characterized by that the heat treatment of the milk is executed at temperatures over 70 degrees Celsius.

10. Barista milk according to one of the previous claims characterized by that the heat treatment of the milk is executed at temperatures at 72 degrees Celsius.
## A. CLASSIFICATION OF SUBJECT MATTER

A23C9/142 (2009.1); A23J1/20 (2009.1); A23C3/02 (2009.1)

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)

EPODOC, WPI, NPL, HCAPPLUS

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

<table>
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<th>Category</th>
<th>Citation of document, with indication, where appropriate, of the relevant passages</th>
<th>Relevant to claim No.</th>
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<tr>
<td>X</td>
<td>WO 0045643 A1 (NATREL INC.) 10-08-2000 See page 3 line 28 - page 4 line 3, claim 9, page 10 lines 1-10, page 6 lines 1-17, claims 10 and 15, page 9 lines 18-24</td>
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<td>X</td>
<td>JP 5076280 A (OYAMA NYUGYO NOGYO KYODO KUMIA) 30-03-1993 See [0023-0024]</td>
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<td>X</td>
<td>US 2006172058 A1 (RONALD ACHS) 03-08-2006 See [0009, 0058]</td>
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Further documents are listed in the continuation of Box C. See patent family annex.

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<td>A</td>
<td>MANGINO et al., Effects of heat processing on the functionality of whey protein concentrates, Journal of Food Science, 1987, vol. 52, no. 6, pages 1522-4</td>
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