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(54) Title: A METHOD OF MANUFACTURING FROZEN DAIRY DESSERT

(57) Abstract: The invention describes the manufacture of a frozen dessert, akin to sorbet, but having the organoleptic properties of ice cream from cooled milk whey. The milk whey could contain desired amount of fat, ranging from little to no fat, depending upon the quality and caloric value of the end product desired. Suitable sweetening agents and binders are added to the whey which is subjected to a process of simultaneous agitation, aeration and freezing, resulting in a frozen dessert with an over run.

TITLE: A method of manufacturing frozen dairy dessert.

5 **FIELD OF INVENTION:** The invention relation to a method of manufacturing a frozen dessert having the organoleptic properties of ice cream from milk whey.

BACKGROUND OF INVENTION: The invention describes a method of manufacturing low
10 calorie frozen dessert with little or no fat content. Ice creams have been perennial favourites as desserts. The palate has grown accustomed to the richness, creaminess and taste of ice creams. Present day emphasis on a low-fat diet has caused health conscious people to cut back on the fat and cream in ice cream, and hence the world over people are seeking techniques for making low calorie frozen desserts. One such low calorie frozen dessert is sorbet.

15 Normal sorbet is made out of water, fruit pulp and/or flavor along with appropriate emulsifiers and stabilizers. It is light, fresh tasting and fluffy when consumed fresh on site. The difficulty with normal sorbet is that it tends to melt quickly and, in cold storage, tends to collapse in to an icy mass, thus having a very limited shelf life.

20 The present invention describes for the first time a frozen dessert from milk whey which may be clarified or used as is, depending upon the extent of fat and smoothness desired in the end product. The frozen dessert, which is a kind of sorbet has the much desired low-fat and low calorie value and the lightness, fluffiness and fresh taste of sorbet, and is akin to ice cream in its creaminess,
25 smoothness, appearance and mouth-feel. In addition, it has a reasonable shelf life.

Whey is the serum remaining after most of the casein and fat from the milk has been removed, but still contains lactose, minerals, dissolved fat and proteins, often referred to as whey proteins. Whey is a voluminous bi-product of the cheese making industry. The use of whey in the form of whey
30 powder of various concentrations of proteins, fat and lactose has been known for some time in the manufacture of ice cream, especially as a cheaper substitute for milk or nonfat milk solids. However the commercial cost of manufacturing whey powder is quite high, which adds to the final cost of ice cream made using whey powders.

In U.S Patent 4840813, of 1989 a method of preparation of low-fat or non-fat frozen desserts using whey protein concentrates has been described. The multi-stage method described in this patent is both complex and elaborate.

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In U.S Patent No.4218482, the inventors have described a dessert mix obtained by preparing solutions of dehydrated powders containing butter fat, non-fat dry-milk solids containing a certain portion of whey protein concentrate, a fructose based sweetening agent and stabilizer.

- 10 The present invention has made use of clarified whey for the first time. Clarified whey is the serum after the dissolved fat and protein have been removed, leaving behind the minerals, lactose, all water soluble vitamins, inorganic nitrogen compounds, peptones and some polypeptides.

- 15 Sorbet made out of clarified whey instead of water thus has the positive characteristics of sorbet, while mitigating some of the limitation of normal sorbet. The physico chemical properties of whey, including its colloidal properties promote locking in of air and foaming and allow for sorbet made out of whey to have the smoothness without ice crystal formation, the lightness, the fluffiness and mouth-feel akin to ice cream , without the high calorie and fat of ice cream. Its slow melting and storage behaviour allows for longer shelf life of the sorbet-like product. This invention describes a
- 20 simple, low cost method for producing an essentially fat- free frozen dessert using milk whey preferably, clarified milk whey.

SUMMARY

In its main aspect the invention relates to a method of making a frozen dessert having the organoleptic properties of ice cream such as appearance, smoothness, creaminess, fluffiness and mouth-feel from cooled milk whey. Depending on the quality of the frozen dessert required, with
5 respect to lightness, creaminess and caloric value, the extent of fat present in the whey could range from little to no fat. A suitable sweetening agent and binder are added to the whey, and this mixture is subjected to a process of simultaneous agitation, aeration and freezing resulting in a frozen dessert with an over run. In another aspect of this invention, the milk whey is subject to a suitable treatment for the removal of dissolved and undissolved fat and protein, so as to obtain clarified whey before it
10 is subjected to a process of simultaneous agitation, aeration and freezing resulting in an over run to obtain a frozen dessert mass which is creamy, fluffy and light. Preferably the whey is subject to acid-heat treatment, which results in the coagulation of fat and protein, and the coagulate is removed to obtain clarified whey. Preferably the pH is adjusted to the range of 6.2 to 6.6 with citric acid to facilitate coagulation.

15 In yet another aspect of this invention, the milk whey is subjected to a process of ultrafiltration, and the residue of proteins and fats is removed to obtain clarified whey. Preferably, the whey irrespective of its fat and protein content, is pasteurised before it is further processed.

20 In yet another aspect of this invention lactase is added, prior to addition of sweetening agent, so that the lactose in the whey may be converted to glucose and galactose. This would reduce the extent of external sweetening agent to be added. In a further aspect of this invention, an emulsifier is added to the whey mix either by itself or along with fruit pulp and/or flavouring agents. In one other aspect of this invention, a small amount of coagulate is also added to the whey mix. In its final aspect, the
25 invention describes a frozen dessert comprising essentially of clarified whey after suitable treatment of milk whey to remove dissolved fat and protein, to which requisite amounts of sweetening agent, binder, emulsifier, fruit pulp and/or flavouring agents are added.

DESCRIPTION

The invention can be better understood by the following description of the process. In its preferred embodiment, the invention describes a method of manufacturing a frozen dairy dessert, having the organoleptic properties of ice cream such a smoothness, creaminess, fluffiness and mouth-feel, from cooled milk whey. Whey is a major bi-product in the cheese manufacturing industry, but for the purpose of this invention the manner of milk whey production is immaterial. The source of the milk whey, whether it is from sheep, goat, camel, cow or buffalo milk is not significant. The extent of fat in the whey used, could range from little to no fat, depending on the quality of the end product of the frozen dessert desired. The whey used therefore may be full whey (FW), defatted whey (DFW) or clarified whey (CLW). The whey is cooled to a temperature of 3 degrees centigrade. A suitable sweetening agent and binder are added to the milk whey. The binder helps to prevent disintegration of the frozen dessert mass when formed. The cooled mixture of whey, sugar and binder is subject to a process of simultaneous agitation, aeration and freezing in an ice cream machine so as to obtain a frozen dessert mass with an overrun. The overrun obtained ranges from 30% to 120% by volume of whey initially used.

TABLE I depicts the extent of over run , appearance and creaminess obtained when full whey (FW), Defatted whey (DFW) and Clarified whey (CLW), along with a sweetening agent and binder are subjected to a process of simultaneous agitation, aeration and freezing.

SORBET EXPERIMENTS: RESULTS OF TRIALS

Scale for overrun, appearance, creaminess: 1 to 3 (1 being best). For overrun: 1=30 to 35% overrun.

TABLE I

NUMBER	BASE+binder + sugar	OVER RUN	APPEARANCE	CREAMINESS
1	Water	2	3, firm translucent	3 like a block
2	Full Whey	1	2 Opaque	1 heavy
3	De Fatted Whey	1	1 Opaque	1 - less heavy than (2)
4	Clarified Whey	1	1 Opaque	1 Creamy

In another embodiment of this invention, the milk whey is subjected to an acid heat treatment. The whey is heated to a temperature of 90 to 95 degrees in a double walled vessel, with very gentle or no stirring until a residue of coagulated protein and fat is formed.

- 5 Just before the coagulated residue is formed, at a temperature of about 90 C, the pH of the milk whey is adjusted to the range of 6.2 to 6.6, preferably with 6ml of 50% solution of citric acid for every 10L of whey, to facilitate complete coagulation of the protein and fat in the milk whey.

- 10 The coagulation of fat occurs at about 70 C to 80 C and the coagulation of protien occurs at 90 to 95 deg. C. The aforementioned residue, which is commonly referred to as ricotta is removed, with a sieve so as to obtain clarified whey.

- 15 The clarified whey is cooled to about 3 C, to which the sweetening agent and binder as mentioned above are added. For safety purposes the mixture of clarified whey, sugar and binder are pasteurised, and cooled to 3C before it is subject to a process of simultaneous agitation, aeration and freezing for 4 minutes to obtain a creamy frozen mass with an overrun . Usually an over run of 40% to 120 % by volume of clarified whey used is obtained.

- 20 In yet another embodiment of this invention, the milk whey is subject to ultra- filtration, to remove the whey protein and obtain a clear permeate of clarified whey. In a commercially viable embodiment of this invention suitable sweetening agent like sugar, an emulsifier like Softeen (06070, Mcc 3 (water emulsifier E471, Sorbit); Via Cerro, 13-47832, S.Andrea di S.Clemente, Italy), and a binder like Neutro (Guarkernmehl E 412, Fa PRE GEL, S.P.A, Comparoni64, Villa Gavassetto, 42029, Reggio Emilia, Italy) is added to the cooled clarified whey to form a dessert premix. The
25 emulsifier enhances storage quality and shelf life. Depending upon the desired flavour, suitable flavoring agents or fruit pulp is also added to the dessert premix. Addition of fruit pulp like peach, or flavours like coffee or malaga results in an excessive over run, of over 110 %. The approximate composition of the premix is as follows:

For every 3 litres of whey (Full whey, clarified whey or defatted whey:

- 30 sugar 750g
emulsifier 15g
binder 10g

In yet another embodiment of this invention, lactase may be added to the clarified whey, so that the

lactose in the clarified whey is converted to glucose and galactose. This would reduce the quantity of sweetening agent required to be added to the dessert premix by 50%. Preferably 1g lactase is added to every 3L of clarified whey and allowed to stand for about 6 hours for the lactose to be hydrolysed to glucose and galactose.

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In yet another embodiment of this invention, a small amount of ricotta is added to the dessert premix.

TABLE II gives the description of the quality of the final product , when to the premix (whey +
10 binder+ sweetening agent) , fruit pulp is added with or without addition of ricotta .
No emulsifier is added..

TABLE II

Premix (Whey + sugar + binder) +/- fruit pulp +/- ricotta

Number	Ingredients/Additives	Overrun	Appearance	Creaminess	Storage Properties	Observations
1	Water, binder, sugar, mangopulp, citric acid	1	2, heavier than no.14	2, less creamy than No.14	Loss of quality at -12°C tends to form an ice block at -25°C	Not very good result
2	CLW, binder, sugar, mangopulp, citric acid	1	1	1	Forms crystals and a sandy mouthfeel on storage at 25°C significant shrinkage	Good result when consumed fresh, but bad storage properties
3	Water, binder, sugar, no pulp	2	3, firm	3, like a block		Bad result
4	CLW, binder, sugar no pulp	1	1	1, creamy		Surprisingly good result
5	CLW, binder, sugar, vanilla flavour	1	1	1	After 24 hours at -12°C significant shrinkage	Not good taste (goat whey plus vanilla - metallic taste)
6	CLW, binder, sugar, malaga flavour	1+	1+	1+	24 hours at -12°C significant shrinkage	First day very good result, second day bad result
7	Water, binder, sugar, mangopulp, 200 g ricotta	2	3	3, heavy with pieces of ricotta left		Bad result, ricotta particles in spite of blending before adding
8	CLW, binder, sugar, mangopulp, 200 g ricotta	1	3	3		Worst result

TABLE III gives the description of the final product when to the premix, emulsifier and fruit pulp are added, with or without addition of ricotta.

Premix (Whey, binder, sugar) + emulsifier + mango pulp with or without ricotta.

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Number	Ingredients/ Additives	Overrun	Appearance	Creaminess	Storage Properties	Observation
1	Water, plus 200 g ricotta	1	2 heavy	2		Little pieces of ricotta remain in icecream
2	CLW,, plus 200g ricotta	1	2,heavy	2		Not a good result
3	CLW, plus 100g ricotta (thoroughly blended in whey)	1	2	1	24h at -12°C, no shrinkage	Ricotta forms clumpy structure while freezing
4	Water	1	1	1	24h at -12°C no change, 1 week at -12°C no shrinkage, but usual loss of quality, 1 month at -25°C no change	Good quality sorbet
5	CLW	1	1	1+	24h at -12°C no change, 4 weeks at 25°C good result	Best result of the experiments whey sorbet shows better structure and porosity than water sorbet after 1 week storage at - 12°C Seems to have better melting properties too.

Number	Ingredients/ Additives	Overrun	Appearance	Creaminess	Storage Properties	Observation
6	DFW	1	1	1	24h at -12°C no change, 1 week at 25°C no shrinkage	Second best result
7	FW	1	1	-1	24h at -12°C no change, 1 week at - -25°C no shrinkage	Not bad, but significantly heavier not as good as CLW
8	WP normal	1	Not so smooth	Less homogeneous	24h at -12°C no change	Good flavour and colour, nice taste
9	WP reduced lactose	1	1	1	24h at -12°C no change	Significantly uninteresting flavour
10	Milk (cow)	1	1	1	24h at -12°C no change	Less fruit flavour and colour than water or whey; more creamy but not fresh tasting.

Scale for overrun, appearance, creaminess: 1 to 3 (being best)

5 For over run 1= 30 to 35% over run .

TABLE IV gives the description of the final product when to the premix, emulsifier and flavours are added.

Number	Ingredients/ Additives	Overrun	Appearance	Creaminess	Storage Properties	Observations
1	CLW plus 1000g blueberry pulp	1	1	+1	24 hours at - -12°C no.change, 1 week at -25° C no shrinkage	Very good result on day 1 and 24h later, even at -25° c
2	CLW plus 1000g peach pulp	+1	Character of 'Softice' 'too fluffy	'not creamy, but fluffy	24h at -12°C shrinkage, loss of fluffiness; harder, compact structure	Pulp was not well blended, significant loss of quality, but fresh and fruity taste
3	CLW plus 30g nescafe, 60g ground coffee	++1 (over 100%)	1	+1	24h at -12 ° C drastic change crumbly, firm structure, bad result	Significant contrast of day 1 and 24h later
4	CLW plus 90g cocoa	1	1	Structure like butter	24h at -12° C loss of creaminess firm structure just like normal chocolate icecream after 24h	Very good taste., fat taste
5	CLW treated with lactase 1/2 sugar 350g	1	1	1		

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Scale for overrun, appearance, creaminess: 1 to 3 (being best).

For over run 1 = 30 to 35% over run

I CLAIM:

1. A method of manufacturing frozen dessert having organoleptic properties of ice cream from cooled milk whey having desired amount of fat ranging from little to no fat, to which a suitable
5 sweetening agent and binder are added and subjected to a process of simultaneous agitation, aeration and freezing resulting in a frozen dessert with an over run.
2. A method as described in claim 1, wherein the milk whey is subjected to suitable treatment whereby dissolved and undissolved fat and proteins are removed, so as to obtain clarified whey
10 which is cooled before it is subjected to a process of simultaneous agitation, aeration and freezing resulting in a frozen dessert with an over run.
3. A method as described in claim 2 wherein the clarified whey is obtained by acid- heat treatment of milk whey resulting in the coagulation of fat and proteins, and removal of the coagulate so
15 formed.
4. A method as described in claim 3 wherein milk whey is heated and the pH is adjusted to a range of 6.2 to 6.6, just prior to the point when coagulation of proteins and fat occurs.
- 20 5. A method as described in claim 4 wherein the pH is adjusted with citric acid.
6. A method as described in claim 1 wherein milk whey is subjected to a process of ultrafiltration, and the residue of proteinss and fats is removed, resulting in clarified whey.
- 25 7. A method as described in claim 5 and 6, wherein the clarified whey is pasteurised.
8. A method as described in claim 7 wherein lactase is added to the chilled clarified whey, prior to addition of sweetening agent.
- 30 9. A method as described in claim 7 or 8 where, in addition, an emulsifier is added to the clarified whey.

10. A method as described in claim 9 where, in addition, fruit pulp is added to the chilled clarified whey.

11. A method as described in claim 11, wherein flavour is added in addition to the fruit pulp or
5 instead of the fruit pulp.

12. A method as described in claim 9, claim 10 and claim 11 wherein less than 5 % by weight of the coagulate of proteins and fat obtained from the milk whey is added to the clarified whey.

10 13. A low-fat dairy dessert having organoleptic properties of ice cream comprising essentially of clarified whey along with requisite amounts of emulsifier, binder, sweetening agent, fruit pulp and/or flavouring agent.

14. A low-fat dairy dessert having organoleptic properties of ice cream made essentially from
15 cooled, clarified whey after suitable treatment of milk whey for removal of dissolved and undissolved proteins and fat.