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(54) **Title**: A PROCESS FOR PRODUCTION OF LOW CHOLESTEROL GHEE

(57) **Abstract**: The present invention relates to a process for preparation of ghee of reduced cholesterol from melted butter serum. The present invention also relates to the process for preparation of ghee of reduced cholesterol without the homogenization of butter serum. Beta cyclodextrin, in a range of 1 % to 10 % by weight of total fat content in the butter serum, is added to the melted butter serum at a temperature in the range of 35 °C to 65 °C. The butter serum is agitated at a speed of 25 rpm to 50 rpm for 30 minutes to 60 minutes. The water serum phase containing cholesterol-beta cyclodextrin complex is separated from the butter serum and the concentrated butter fat serum of reduced cholesterol content is collected. Heating the concentrated butter fat serum to a temperature of 102 °C to 108 °C for a sufficient time to remove all moisture content provides ghee of reduced cholesterol.

A PROCESS FOR PRODUCTION OF LOW CHOLESTEROL GHEE

Field of invention

The present invention relates to a process for preparation of ghee of reduced cholesterol from melted butter serum. The process of the present invention is a simplified process resulting in effective removal of cholesterol without affecting the quality of the product in terms of flavour, granularity and consistency.

The present invention further relates to the process for preparation of ghee of reduced cholesterol without the homogenization of butter serum.

Background of the invention

Ghee is clarified butter that has been cooked longer to remove almost all the moisture and clarified to remove all unwanted solid matters, which is traditionally used in Indian cuisines. Ghee has a longer shelf life, both refrigerated and at room temperature than butter. Ghee can be prepared from milk of cow, buffalo, or mixture thereof. It contains 0.25% to 0.40% of cholesterol. Cholesterol mostly comes from animal fat, but people misconceive it to be a common feature of all oils and ghee. There are two types of fats, saturated and unsaturated fats. Unsaturated fats are favorable for the body, whereas saturated fats clog the arteries and can lead to health hazards. Cholesterol, as per Ayurveda, is an essential part of a healthy person and should be maintained as per the body requirement. Currently available cholesterol-lowering drugs are promoted as safer and more effective, but most of the studies have failed to

demonstrate a decrease in those taking them and the risks and side-effects appear to be similar to those seen with earlier medications.

Hence this necessitated the need to find ways to lower cholesterol more effectively.

US Patent No. 6110517 discloses the preparation of low cholesterol milk or low cholesterol cream by homogenizing milk or cream prior to removal of cholesterol. The fat and SNF components of milk are then recombined by undergoing another homogenization process step. Through this process the amount of beta cyclodextrin used in accordance to milk fat percentage for removal of cholesterol from pure milk or cream is very high.

The process of US Patent No. 5264226 requires chilling of milk-betacyclodextrin mixture below 4°C for removal of only 52 % cholesterol, while from cream the binding agent used for removal of cholesterol is a polymerized product of Beta Cyclodextrin and reduction of cholesterol achieved is also very low at 42%.

WO 99/17620 discloses the process for removal of cholesterol contained in an emulsion of animal origin fat having fat globules of variable size and includes the step of reducing the size of fat globules of the emulsion to a predetermined size (0.76 micron -0.99 micron) by homogenizing the milk at a pressure of 200 kg/cm^2. The milk-cyclodextrin mixture is mixed at 500 rpm for 10 minutes at 0^0C and then centrifuged at 40C for 1 minute at 6500 rpm. After discarding cholesterol-cyclodextrin complex, mix the cream & skim milk portions.

Owing to the adverse effects of dairy cholesterol on human health, a process has been developed which can remove up to 95% of cholesterol while preparing ghee. The present invention provides an effective process for commercial production of low cholesterol ghee that protects people against heart diseases and hypertension. While this ghee is not only beneficial to the health conscious, its shelf life is also same as normal ghee.

Summary

The present invention relates to a process for preparing ghee of reduced cholesterol content, said process comprising providing a melted butter serum at a temperature in the range of 35°C to 65°C; adding beta cyclodextrin in a range of 1% to 10% by weight of total fat content in the butter serum; agitating the butter serum at an agitator speed of 25 rpm to 50 rpm for 30 minutes to 60 minutes at a temperature in the range of 30°C to 55°C; separating a water serum phase containing cholesterol-beta cyclodextrin complex from the butter serum to obtain a concentrated butter fat serum of reduced cholesterol content; optionally adding 15% v/v to 25% v/v of water to the concentrated butter fat serum followed by repeating the above process steps of adding beta cyclodextrin, agitating and obtaining the concentrated butter fat serum; and heating the concentrated butter fat serum to a temperature of 102°C to 108 °C for a sufficient time to remove all moisture content, to obtain ghee of reduced cholesterol.

The present invention further relates to the process for producing ghee of reduced cholesterol, wherein the ghee of reduced cholesterol is further subjected to filtering, clarification and controlled cooling.

These and other features, aspects, and advantages of the present subject matter will become better understood with reference to the following description and appended claims. This summary is provided to introduce a selection of concepts in a simplified form. This summary is not intended to identify key features or essential features of the claimed subject matter, nor is it intended to be used to limit the scope of the claimed subject matter.

Detailed Description of Invention

The present invention provides a process for preparing ghee of reduced cholesterol content, said process comprising:

providing a melted butter serum at a temperature in the range of 35°C to 65°C;

adding beta cyclodextrin in a range of 1% to 10% by weight of total fat content in the butter serum;

agitating the butter serum at an agitator speed of 25 rpm to 50 rpm for 30 minutes to 60 minutes at a temperature in the range of 30°C to 55°C;

separating a water serum phase containing cholesterol-beta cyclodextrin complex from the butter serum to obtain a concentrated butter fat serum of reduced cholesterol content;

optionally adding 15% v/v to 25% v/v of water to the concentrated butter fat serum followed by repeating the above process steps of adding beta cyclodextrin, agitating and obtaining the concentrated butter fat serum; and

heating the concentrated butter fat serum to a temperature of 102°C to 108 °C for a sufficient time to remove all moisture content, to obtain ghee of reduced cholesterol.

In an embodiment of the present invention, the process further comprises filtering of the ghee of reduced cholesterol and subjecting it to clarification and controlled cooling.

In another embodiment of the present invention, it provides process for preparing ghee of reduced cholesterol content, said process comprising:

providing a melted butter serum at a temperature of about 35°C to 65°C;

adding beta cyclodextrin in a range of 1% to 10% by weight of total fat content in the butter serum;

agitating the butter serum at an agitator speed of 25 rpm to 50 rpm for 30 minutes to 60 minutes at a temperature in the range of 30°C to 55°C;

separating a water serum phase containing cholesterol-beta cyclodextrin complex from the butter serum to obtain a concentrated butter fat serum of reduced cholesterol content;

adding 15% v/v to 25% v/v of water to the concentrated butter fat serum followed by repeating the above process steps of adding beta cyclodextrin, agitating and obtaining the concentrated butter fat serum; and

heating the concentrated butter fat serum to a temperature of 102°C to 108 °C for a sufficient time to remove all moisture content, to obtain ghee of reduced cholesterol.

In yet another embodiment, the process of the present invention is devoid of homogenization step.

In yet another embodiment, the temperature of the melted butter serum is in the range of 40°C to 55°C.

In yet another embodiment, the temperature of the melted butter serum is in the range of 45°C to 50°C.

In a further embodiment, beta cyclodextrin is added in a range of 4% to 8% by weight of total fat content in the butter serum.

In yet another embodiment, the butter serum is agitated for 45 minutes to 60 minutes at a temperature in the range of 40°C to 55°C.

In yet another embodiment, the separation of the water serum phase containing cholesterol-beta cyclodextrin complex from the butter serum is by centrifugation.

In yet another embodiment, the cholesterol is reduced by 70% to 95% by employing the process of the present invention.

EXAMPLES

The following example is given by way of illustration of the present invention and should not be construed to limit the scope of present disclosure. It is to be understood that both the foregoing general description and the following detailed description are exemplary and explanatory only and are intended to provide further explanation of the claimed subject matter.

Example 1:

Butter was prepared through continuous butter making machine (CBM). Butter coming out from the CBM was pumped to the butter melting coils and melted butter serum was collected in a balance tank having an agitation facility. The melted butter

serum temperature was kept at preferably not greater than 65°C, more preferably from 40°C to 55°C and most preferably from 40°C to 48°C.

Beta cyclodextrin was taken in the range of 1%–10% by weight of milk fat in the balance tank, preferably between 1%– 8 % by weight, and more preferably between 4%–8% of total fat taken in the balance tank. It was dissolved in 30 – 40 litres of water.

Half of Beta cyclodextrin water solution was added to the melted butter serum in the tank at a temperature preferably not greater than 65°C, more preferably from 40°C to 55°C and most preferably from 40°C to 48°C. The mixture was stirred gently (agitator speed 25 – 50 rpm) at 40°C - 55°C for preferably not greater than 90 minutes, more preferably from 30 to 60 minutes and most preferably from 45 to 60 minutes. The treated butter serum-beta cyclodextrin mixture was fed to a serum separator. The water phase along with added cholesterol-cyclodextrin complex was removed from the butter serum phase to obtain a concentrated butter fat serum.

Example 2:

The addition of beta-cyclodextrin for effective removal of cholesterol can be repeated again. For this, the concentrated butter serum phase separated from first step treatment may or may not be mixed back with water serum separated. 25% v/v of water was added to the contents of the tank and the contents of the tank was heated to temperature preferably not greater than 65°C, more preferably from 40°C to 55°C and most preferably from 40°C to 48°C. The second half of Beta cyclodextrin water solution was now added into the tank at temperature preferably not greater than 60°C, more preferably from 35°C to 55°C and most preferably from 35°C to 40°C. The mixture was stirred gently (agitator speed 25 – 50 rpm) at 35°C - 40°C for preferably not greater than 90 minutes, more

preferably from 30 to 60 minutes and most preferably from 45 to 60 minutes. It was then fed to serum separator. The water phase along with added cholesterol-cyclodextrin complex was removed from the butter serum phase.

The two step treatment of concentrated butter serum has been found to be more advantageous than the single step removal of cholesterol. It has been experimentally observed that single step binding of cholesterol with cyclodextrin is achievable up to 70 % only while in combination with second step treatment the removal of cholesterol is about 95%, more specifically from 88% to 95%, and most specifically from 88 to 92 % of the original levels in untreated milk fat.

Example 3:

The separated concentrated butter fat serum of example 1 or 2 was taken to Ghee Kettle for cooking and converting it to low cholesterol Ghee. All remaining moisture in the butter serum was removed during cooking and in the process small amounts of milk SNF got cooked during heating in the open pan. The prepared Ghee was filtered and transferred to the settling tank, wherein the burnt/cooked milk SNF in the form of residue was settled and separated by gravity. The Ghee was then clarified and then transferred for cooling in a filling tank, which was jacketed for controlled cooling prior to its packing. The packed ghee was transferred to cold room for granulation.

Example 4: Level of addition of Beta-Cyclodextrin

700 kg butter serum containing 84% milk fat was taken as starting material and added with a first part of beta cyclodextrin prepared at an amount of 3%, 5%, 7% and 8% respectively on weight of fat content. The amount of cyclodextrin for dissolving in 40 litres of water was calculated on fat basis of the butter serum. Half of the amount of

cyclodextrin dissolved in 40 litres of water was added to butter serum at temperature preferably not greater than 65°C, more preferably from 40°C to 55°C and most preferably from 40°C to 48°C and was stirred gently (agitator speed 25–50 rpm). The butter serum was separated by centrifugal method of separation. The remaining second half of the amount of cyclodextrin was added during step treatment and cholesterol removed butter serum was obtained.

The separated concentrated butter fat serum was then cooked in an open pan for conversion into Ghee. Table 1 shows the effect of level of beta- cyclodextrin for the removal of cholesterol.

Table 1:

Level of addition	Amount of Cyclodextrin (kg) dissolved in water	Cholesterol level as mg/ 100 g	Removal proportion of Cholesterol (%)
Control	0	91.40	0.00
3 %	17.64	14.44	84.2
5 %	29.40	9.59	89.5
7 %	41.16	9.14	90.0
8 %	47.04	8.95	90.2

Example 5: Effect of temperature.

The temperature of treatment of beta cyclodextrin also affects the level of removal of cholesterol from melted butter serum.

700 kg butter serum containing 84% milk fat was taken as starting material and added with a first part of beta cyclodextrin prepared at an amount of 7% - 8% respectively on

weight of fat content. All the variable temperature treatment experiments were conducted at temperatures 35°C, 40°C, 45°C and 50°C respectively.

Half of the amount of cyclodextrin dissolved in 40 litres of water was added to butter serum at different temperatures as mentioned above and was stirred gently (agitator speed 25 –50 rpm). The butter serum was separated by centrifugal method of separation. The remaining second half of the amount of cyclodextrin was added during second step treatment and cholesterol removed butter serum was obtained. The separated concentrated butter fat serum was then cooked in an open pan for conversion into Ghee. Table 2 shows the effect of temperature of treatment of Cyclodextrin on removal of Cholesterol.

Table 2:

Temperature of treatment	Cholesterol level as mg/ 100 g	Removal proportion of Cholesterol (%)
Control	90.60	0.00
35^0C	13.04	85.6
40^0C	11.32	87.5
45^0C	8.88	90.2
50^0C	9.51	89.5

Example 6: Effect of time of agitation.

Effect of the time period of agitation during treatment was also studied on removal of cholesterol from melted butter serum.

700 kg butter serum containing 84% milk fat was taken as starting material and added with a first part of beta cyclodextrin prepared at an amount of 7% - 8% respectively on weight of fat content. All the variable agitator speed experiments were conducted at 48°C respectively.

Half of the amount of cyclodextrin dissolved in 40 litres of water was added to butter serum at 48°C and was stirred gently (agitator speed 25– 50 rpm). The time period at this agitator speed was kept variable at 30 minutes, 60 minutes and 90 minutes. The butter serum was separated by centrifugal method of separation. The remaining second half of the amount of beta cyclodextrin was also added during second step treatment and stirred gently (agitator speed 25–50 rpm) while using variable time as stated above and cholesterol removed butter serum was obtained.

The separated concentrated butter fat serum was then cooked in an open pan for conversion into Ghee. Table 3 shows effect of holding period during agitation on removal of Cholesterol.

Table 3:

Holding period in minutes	Cholesterol level as mg/100 g	Removal proportion of Cholesterol(%)
0	92.6	0.00
30	12.6	86.4
60	8.33	91.0
90	8.89	90.4

Example 7: Effect of speed of agitation.

700 kg butter serum containing 84% milk fat was taken as starting material and added with a first part of beta cyclodextrin prepared at an amount of 7% - 8% respectively on weight of fat content. All the variable agitator speed experiments were conducted at 48°C respectively. Half of the amount of beta cyclodextrin dissolved in 40 litres of water was added to butter serum at 48°C and was stirred. The speed of agitation was kept variable at 25, 40, 50 and 75 rpm. The butter serum was separated by centrifugal method of separation. The remaining second half of the amount of cyclodextrin was also added during second step treatment while using variable speed levels as stated above and cholesterol removed butter serum was obtained.

The separated concentrated butter fat serum was then cooked in an open pan for conversion into Ghee. Table 4 shows effect of speed of agitation of Cyclodextrin on removal of Cholesterol.

Table 4:

Speed of agitation in rpm	Cholesterol level as mg/ 100 g	Removal proportion of Cholesterol (%)
0	91.2	0.00
25	9.30	89.8
40	8.39	90.8
50	10.94	88.0
75	12.49	86.3

Example 8: Effect of variable step treatment

Table 5 shows the effect of variable step treatment on removal of Cholesterol, as in example 1 and 2.

Table 5

Step	Cholesterol level as mg/ 100 g	Removal proportion of Cholesterol (%)
Control	91.0	0.00
Single step	10.73	88.2
Two step	8.55	90.6

Although the subject matter has been described in considerable detail with reference to certain preferred embodiments thereof, other embodiments are possible. As such, the spirit and scope of the appended claims should not be limited to the description of the preferred embodiment contained therein.

We Claim:

1. A process for preparing ghee of reduced cholesterol content, said process comprising:

providing a melted butter serum at a temperature in the range of 35°C to 65°C;

adding beta cyclodextrin in a range of 1% to 10% by weight of total fat content in the butter serum;

agitating the butter serum at an agitator speed of 25 rpm to 50 rpm for 30 minutes to 60 minutes at a temperature in the range of 30°C to 55°C;

separating a water serum phase containing cholesterol-beta cyclodextrin complex from the butter serum to obtain a concentrated butter fat serum of reduced cholesterol content;

optionally adding 15% v/v to 25% v/v of water to the concentrated butter fat serum followed by repeating the above process steps of adding beta cyclodextrin, agitating and obtaining the concentrated butter fat serum; and

heating the concentrated butter fat serum to a temperature of 102°C to 108 °C for a sufficient time to remove all moisture content, to obtain ghee of reduced cholesterol.

2. The process as claimed in claim 1, wherein said process further comprises filtering of the ghee of reduced cholesterol and subjecting it to clarification and controlled cooling.

3. A process for preparing ghee of reduced cholesterol content, said process comprising:

providing a melted butter serum at a temperature of about 35°C to 65°C;

adding beta cyclodextrin in a range of 1% to 10% by weight of total fat content in the butter serum;

agitating the butter serum at an agitator speed of 25 rpm to 50 rpm for 30 minutes to 60 minutes at a temperature in the range of 30°C to 55°C;

separating a water serum phase containing cholesterol-beta cyclodextrin complex from the butter serum to obtain a concentrated butter fat serum of reduced cholesterol content;

adding 15% v/v to 25% v/v of water to the concentrated butter fat serum followed by repeating the above process steps of adding betacyclodextrin, agitating and obtaining the concentrated butter fat serum; and

heating the concentrated butter fat serum to a temperature of 102°C to 108°C for a sufficient time to remove all moisture content, to obtain ghee of reduced cholesterol.

4. The process as claimed in any of the claims 1 to 3, wherein the temperature of the melted butter serum is in the range of 40°C to 55°C.

5. The process as claimed in any of the claims 1 to 3, wherein the temperature of the melted butter serum is in the range of 45°C to 50°C.

6. The process as claimed in any of the claims 1 to 3, wherein beta cyclodextrin is added in a range of 4% to 8% by weight of total fat content in the butter serum.

7. The process as claimed in any of the claims 1 to 3, wherein the butter serum is agitated for 45 minutes to 60 minutes at a temperature in the range of 40°C to 55°C.

8. The process as claimed in any of the claims 1 to 3, wherein the separation of the water serum phase containing cholesterol-beta cyclodextrin complex from the butter serum is by centrifugation.

9. The process as claimed in any of the claims 1 to 8, wherein the cholesterol is reduced by 70% to 95%.

10. A ghee of reduced cholesterol prepared by process as claimed in any of the claims 1 to 9.