

PROCESS OF PRODUCING EDIBLE COCONUT PRODUCTS

Field of the Invention

5 This invention relates to a process of producing edible coconut products. More particularly, this invention relates to a process of producing edible coconut products including coconut flour, spreadable coconut butter and concentrated coconut milk that have enhanced usability, stability and shelf life.

10 Background

Mature coconut kernel is widely used in various foods. Desiccated coconut and coconut milk especially are established industries with millions in trade over the past decades. In recent years, the appeal of coconut food products has broadened with the increasing
15 popularity of coconut water and virgin coconut oil, especially in the North American and European markets. With this opening and expansion of the markets in coconut food products, come the opportunities to address some of the challenges and gaps in the way consumers and manufacturers utilize one of the most nutritious foods on the planet.

20 Coconut milk, with fat content of 15 to 25 percent, is mainly produced using aseptic or canning technology to extend its shelf life. This method involves higher packaging and transportation costs due to the high water content present in the coconut milk. Some manufacturers choose to pasteurize and chill the coconut milk for the local market. Such coconut milk generally has a shorter shelf life, of no more than a week.

25 Coconut milk/cream products also commonly contain additives such as guar gum and other emulsifiers to prevent separation of the fat and water layers within the coconut milk/cream.

30 The more recent coconut food entrants to the market have been coconut flour, coconut concentrate (also known as creamed coconut). Both have not penetrated the mainstream market yet to any great extent, although they have met with great enthusiasm amongst specialist food communities like vegans and primal eating communities.

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Coconut flour currently available on the market is often coarse, has a brownish beige colour with a burnt smell. This is a result of the method employed in processing the coconut in which the coconut is subjected to high temperatures. There is also difficulty in grinding the coconut to sufficient fineness.

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Coconut concentrate currently available on the market has a tendency of settling at the bottom of its container over time to form a hard solid base layer and a large portion of floating oil layer. These layers are difficult to recombine. Using emulsifiers to homogenize the mixture is undesirable as the market segment that currently consumes this product does not welcome food additives, for example, consumers with health concerns and a preference for natural food products.

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As such, efforts have been made to consider alternatives to these more recent coconut edible products to improve properties such as texture, taste, viscosity, stability and mouthfeel, so as to broaden the mainstream appeal and usability of this nutritious food substance.

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It is therefore desirable to provide coconut edible products and process of producing the same that seek to address at least one of the problems described hereinabove, or at least to provide alternatives.

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Summary of Invention

In accordance with a first aspect of this invention, a process of producing edible coconut products is provided. The process comprises introducing desiccated coconut into a grinding apparatus; grinding the desiccated coconut in the grinding apparatus to obtain a first coconut concentrate; introducing the first coconut concentrate into a high speed cutting machine to further process the first coconut concentrate to obtain a second coconut concentrate; and subjecting the second coconut concentrate to centrifugation in a basket centrifuge at a speed of 500 to 3,000 rpm for a predetermined period of time to obtain a coconut product and a filtrate consisting of cloudy coconut oil.

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In accordance with one embodiment of this invention, the second coconut concentrate is centrifuged in the basket centrifuge for 30 to 150 minutes to obtain the coconut product and the filtrate consisting of cloudy coconut oil.

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In accordance with an embodiment of this invention, the coconut product is coconut flour.

- 5 In accordance with another embodiment of this invention, the second coconut concentrate is centrifuged in the basket centrifuge for 3 to 10 minutes to obtain the coconut product and the filtrate consisting of cloudy coconut oil.

- 10 In accordance with an embodiment of this invention, the process further comprises subjecting the coconut product to further processing in the high speed cutting machine to obtain a second coconut product, wherein the second coconut product is a spreadable coconut butter.

- 15 In accordance with yet another embodiment of this invention, the process further comprises passing the cloudy coconut oil through the high speed cutting machine to obtain a third coconut product, wherein the third coconut product is a concentrated coconut milk.

- 20 In accordance with a second aspect of this invention, a coconut flour obtainable by the process of the present invention is provided. The coconut flour comprises 60 to 90% by weight of coconut fiber and a fat content of 10 to 40%, based on the total weight of the coconut flour, and having an average particle size of 5 to 400 microns, preferably 10 to 200 microns, and more preferably 10 to 65 microns.

- 25 In accordance with a third aspect of this invention, a spreadable coconut butter obtainable by the process of the present invention is provided. The spreadable coconut butter comprises 45 to 55% by weight of coconut fiber and a fat content of 45% to 55%, based on the total weight of the spreadable coconut butter, and having an average particle size of 5 to 300 microns, preferably 10 to 150 microns, and more preferably 10
30 to 60 microns.

- In accordance with a fourth aspect of this invention, a concentrated coconut milk obtainable by the process of the present invention is provided. The concentrated coconut milk comprises 5 to 15% by weight of coconut fiber and a fat content of 85 to
35 95%, based on the total weight of the concentrated coconut milk, and having an

average particle size of 5 to 200 microns, preferably 10 to 100 microns, and more preferably 10 to 50 microns.

Detailed Description

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The present invention relates to a process of producing edible coconut products. More particularly, the invention relates to a process of producing edible coconut products including coconut flour, spreadable coconut butter and concentrated coconut milk. The edible coconut products produced in accordance with the process of the present invention have enhanced usability, stability and shelf life. The products also have superior taste, texture and mouthfeel, as well as improved storage and shipping parameters.

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In accordance with an embodiment of the invention, the process comprises the steps of introducing desiccated coconut into a grinding apparatus, and grinding the desiccated coconut in the grinding apparatus to obtain a first coconut concentrate.

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“Coconut Concentrate” as used herein refers to a composition comprising mainly of coconut fibres and oil, with a moisture content of less than 2.5%.

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Any suitable type of desiccated coconut can be used in the process including, but not limited to, the form of flakes, shredded and granules. In one embodiment of the invention, the desiccated coconut is in the form of granules. Any suitable sizes of granules may be used. The desiccated coconut has a moisture content of 0.5 to 2.5% by weight, based on the total weight of the desiccated coconut. The desiccated coconut also has a fat content of more than 60% by weight, based on the total weight of the desiccated coconut. The low moisture content and high fat content of the desiccated coconut helps facilitate the grinding operation. The amount of desiccated coconut to be used will depend on the desired end product that is to be produced in the process of the present invention.

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The desiccated coconut is grinded in the grinding apparatus until a first coconut concentrate is produced. The first coconut concentrate preferably has an average particle size of 100 to 2,000 microns, the smaller the better. It should be appreciated

that any suitable grinding apparatus may be used without departing from the scope of the present invention.

5 The first coconut concentrate is then transferred to a high speed cutting machine to produce a second coconut concentrate. Preferably, the second coconut concentrate has an average particle size of 1 to 400 microns. Any suitable type of high speed cutting machine may be used without departing from the scope of the present invention as long as the machine is able to grind or cut the first coconut concentrate to a smaller particle size of 1 to 400 microns. In one embodiment, the second coconut concentrate
10 is subjected to processing in the high speed cutting machine at a speed of 3,000 to 12,000 rpm.

The second coconut concentrate obtained is then subjected to centrifugation in a basket centrifuge to partially separate the particles, including the coconut fibres present
15 in the second coconut concentrate, from the oil.

Any suitable type of basket centrifuge may be used without departing from the scope of the invention. Preferably, the basket centrifuge comprises a perforated basket of generally frusto-conical configuration, lined with a nylon filter cloth having perforations
20 of 40 to 200 microns. The basket centrifuge is adapted to rotate about a rotational axis and along whose inner peripheral wall the second coconut concentrate is introduced and centrifuged, with the particles including coconut fibers being retained in the perforated basket and the filtrate being discharged and collected via the basket perforations. The centrifugation is carried out at a speed of 500 to 3,000 rpm for a
25 predetermined period of time, preferably 1 to 150 minutes.

In one embodiment of the invention, the centrifugation is carried out at a speed of 500 to 3,000 rpm for 30 to 150 minutes. Centrifuging the second coconut concentrate at this speed gives excellent results, and involves the separation of the second coconut
30 concentrate into two fractions, consisting of a solid coconut product that is retained in the perforated basket and a filtrate consisting of cloudy coconut oil. The coconut product produced in this embodiment is coconut flour.

The coconut flour comprises 60 to 90% by weight, preferably 70 to 80% by weight of
35 coconut fiber, based on the total weight of the coconut flour. The coconut flour has an

average particle size of 5 to 400 microns, preferably 10 to 200 microns, more preferably 10 to 65 microns. The coconut flour has a fat content of 10 to 40% by weight, based on the total weight of the coconut flour. The fat content can be adjusted to desired amount based on the processing time of the second coconut concentrate in the basket centrifuge. If a higher fat content within the coconut flour is desired, a shorter centrifuging time is employed. If a lower fat content within the coconut flour is desired, then a longer centrifuging time is employed.

The coconut flour produced in accordance with the process of the present invention has a fine and soft texture, whitish in colour and can be used directly without any further treatment. The coconut flour has a superior flavour and aroma, as well as improved texture and mouthfeel. It can be consumed raw or added directly to food and beverages without further cooking. If desired, it can be used as a flour substitute in baking or cooking recipes. The coconut flour does not have a burnt smell or brownish colour, unlike some of the coconut flour produced using conventional methods known in the art. Conventional coconut flour has to be further processed by either adding to the food products to be baked or cooked before consumption.

The coconut flour is best stored in refrigerator or in sealed packages or containers and in dry area with no moisture contamination. Under these storage conditions, the coconut flour can have a shelf life of about 18 months. This is made possible due to the low moisture content of the coconut flour.

In a second embodiment of the invention, the centrifugation is carried out in the basket centrifuge at a speed of 500 to 3,000 rpm for 3 to 10 minutes, preferably 6 minutes. This step in the second embodiment produces a third coconut concentrate that is retained in the basket centrifuge and a filtrate consisting of cloudy coconut oil.

The third coconut concentrate is subjected to further processing in the high speed cutting machine to produce a second coconut product, which in this case, is a spreadable coconut butter.

The high speed cutting machine as used in this embodiment can be the same or different from the one used in accordance with the first embodiment. Any suitable type may be used without departing from the scope of the present invention as long as the

machine is able to process the third coconut concentrate into smaller average particle size to obtain the desired spreadable coconut butter.

The term "spreadable" as used herein means at and above room temperature, the coconut butter can be readily spread onto an area or a substrate using a knife, or the like.

As used herein, room temperature is defined to be approximately 25°C.

The spreadable coconut butter obtained in this step has an average particle size of 5 to 300 microns, preferably 10 to 150 microns and more preferably 10 to 60 microns. The fat content is in the range of 45 to 55% by weight, based on the total weight of the spreadable coconut butter. The spreadable coconut butter has a smooth texture and a viscosity that allows it to be readily spread over an area or a substrate, for example, confectionery and bakery products. Its use is similar to products like peanut or other nut butters, with the added nutritional benefit of containing dietary fibre and beneficial medium chain fatty acids such as lauric acid. Preferably, the spreadable coconut butter comprises 45 to 55% by weight of coconut fiber, based on the total weight of the spreadable coconut butter.

The spreadable coconut butter is stable and will not separate easily into different layers at room temperature. This provides ease of handling and use to the consumers as at or above room temperature, the spreadable coconut butter can be used instantaneously without mixing or shaking and can be readily spread over food products.

Below room temperature, the spreadable coconut butter will solidify. In order to facilitate ease of use for consumers in cooler climates, a table-top warming cabinet can be used to maintain the temperature of the spreadable coconut butter at 26°C and above so that the spreadable coconut butter can readily be used when needed. Any suitable type of table-top warming cabinet may be used.

The process in accordance with the present invention further comprises passing the cloudy coconut oil through the high speed cutting machine to obtain a third coconut product. The third coconut product in this case is a concentrated coconut milk. Passing the cloudy coconut oil through a high speed cutting machine allows one to control and

adjust the level of dietary fibre content in the concentrated coconut milk according to the amount desired. This step is unique to the invention, and it is not achievable in currently marketed coconut milk products.

- 5 The cloudy coconut oil used in this step can come from the one produced in accordance with the first embodiment of the invention, the second embodiment of the invention or a combination thereof.

10 The term "concentrated coconut milk" is used herein because the product performs the same function as coconut milk except without the water content. As a substance, the concentrated coconut milk behaves much the same as virgin coconut oil in, for example pourable liquid consistency at and above room temperature, and being a solid below 25°C.

15 The concentrated coconut milk contains hardly any water as compared to coconut milk/cream. It has a moisture content of about 0.5 to 1.0% by weight, based on the total weight of the concentrated coconut milk. The concentrated coconut milk has a fat content of 85 to 95% by weight, based on the total weight of the coconut cream concentrate. Preferably, the average particle size of the concentrated coconut milk is 5
20 to 200 microns, preferably 10 to 100 microns, and more preferably 10 to 50 microns. The dietary fibre content in the concentrated coconut milk can be controlled as desired in the process, as mentioned hereinabove. This is different from the coconut milk/cream currently available in the market as the coconut milk/cream currently available in the market does not contain any dietary fibre. In one embodiment, the concentrated
25 coconut milk comprises 5 to 15% by weight of coconut fiber, based on the total weight of the concentrated coconut milk.

The concentrated coconut milk is stable at room temperature. While it does separate into different layers of coconut oil and a small amount of coconut fibre when it is left at
30 or above room temperature, all it requires is a gentle shake to recombine the different layers fully. The coconut fibre component does not settle into a solid hard layer like coconut butter products currently found in the market. The concentrated coconut milk does not need to be kept refrigerated. It can be stored at room temperature or in table-top warming cabinet in cooler climates to maintain the temperature of the concentrated
35 coconut milk in the range of 26°C and above that the concentrated coconut milk can

readily be used when needed. The process of producing the concentrated coconut milk allows the concentrated coconut milk to have a longer shelf life, of about 18 months without refrigeration, as long as there is no moisture contamination. This is made possible due to its low moisture content.

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In general, the concentrated coconut milk can be used for a variety of purposes. For example, it can be added to beverages or cooking dishes wherever coconut or creamy flavours are desired. It can be used anywhere one might have previously used coconut milk or cream. It can be added to smoothies or shakes, coffees and hot chocolate
10 beverages, with the added bonus of being vegan and dairy-free. It can be added to soups, stews or curries, where it has the advantage of not only contributing a robust flavour but also in thickening the gravy. The concentrated coconut milk can be incorporated in bakery products with or without dilution with water.

15 Due to its shelf stable state, the concentrated coconut milk does not require sophisticated and costly packaging methods like canning or aseptic packaging systems, nor does it require sterilisation or pasteurisation. Simple bottles or sachet packaging is sufficient to maintain the quality of the product on the shelf. In an exemplary embodiment, the concentrated coconut milk is packed in a ready to use sachet.

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In general, the three products produced in accordance with the process of the present invention have greatly improved storage characteristics. Due to the relatively low moisture content and as a result, its much reduced mass and weight, the concentrated coconut milk is cheaper to store and transport as compared to conventionally produced
25 coconut milk/cream. The products of the present invention are stable at room temperature (at 25°C) and have longer shelf life as compared to some of the conventional coconut products known in the art. As such, the products of the present invention are easy to handle, transport and store. The step involved in subjecting the coconut concentrate to further processing in the high speed cutting machine further
30 reduces the particle sizes of the fibres in the coconut concentrate and this in turn, prevents sedimentation of the final products produced in accordance with the present invention.

The products of the present invention may be used directly without any further
35 treatment. The products may be produced without the addition of any additives.

In accordance with another aspect of the present invention, a coconut flour is provided. The coconut flour comprises 60 to 90% by weight, preferably 70 to 80% by weight of coconut fiber, based on the total weight of the coconut flour. The coconut flour has a fat content of 10 to 40% by weight, based on the total weight of the coconut flour, and an average particle size of 5 to 400 microns, preferably 10 to 200 microns, and more preferably 10 to 65 microns.

In accordance with a further aspect of the present invention, a spreadable coconut butter is provided. The spreadable coconut butter comprises 45 to 55% by weight of coconut fibre, preferably 50%, based on the total weight of the spreadable coconut butter. The spreadable coconut butter has a fat content of 45 to 55% by weight and a moisture content of 1 to 3% by weight, based on the total weight of the spreadable coconut butter. The spreadable coconut butter has an average particle size of 5 to 300 microns, preferably 10 to 150 microns, and more preferably 10 to 60 microns.

In accordance with yet a further aspect of the present invention, a concentrated coconut milk is provided. The concentrated coconut milk comprises 5 to 15% by weight of coconut fiber and a fat content of 85 to 95% by weight, based on the total weight of the concentrated coconut milk. The concentrated coconut milk has an average particle size of 5 to 200 microns, preferably 10 to 100 microns, and more preferably 10 to 50 microns.

The following examples illustrate various embodiments of this invention. One skilled in the art will recognize that the examples set out below are not an exhaustive list of the embodiments of this invention.

Example

Example 1 - Coconut Flour

The source material employed was commercial desiccated coconut, in granules form, having a moisture content of 0.5 to 2.5% and a fat content of more than 60% by weight, based on the total weight of the desiccated coconut. This was added to a grinding apparatus (type MKAZ10-20J, manufactured by Masuko Sangyo). The desiccated

coconut passed through the grinder to produce a first coconut concentrate having an average particle size of 100 to 2,000 microns. The first coconut concentrate was then transferred to a high speed cutting machine (type ultra-precise cutting machine "Micro-Meister", manufactured by Masuko Sangyo). The high speed cutting machine

5 comprises about 50 to 220 micro knives and operates at a speed of 3,000 to 12,000 rpm. The first coconut concentrate was put through the high speed cutting machine to produce a second coconut concentrate having an average particle size of 1 to 400 microns.

10 The second coconut concentrate was then transferred to a basket centrifuge. The basket centrifuge used in this example has side walls lined with a nylon filter cloth having perforations of 40 to 150 microns. The basket was rotated at a speed of 500 to 3,000 rpm for 90 minutes. After which, the filtrate consisting of a cloudy coconut oil was discharged and collected for further processing and the solid coconut product retained

15 in the basket was removed from the basket. The solid coconut product obtained in this step was coconut flour. The coconut flour has an average particle size of 34 microns. The coconut flour was collected and sent for analysis. The contents of the coconut flour obtained in accordance with this process are shown in Table 1 below.

20 Example 2 - Spreadable Coconut Butter

The second coconut concentrate having an average particle size of 1 to 400 microns of Example 1 was transferred to the basket centrifuge. The basket was rotated at a speed of 500 to 3,000 rpm for 3 to 10 minutes. In this example, the basket was rotated for

25 about 6 minutes. After which, the filtrate consisting of a cloudy coconut oil was discharged and collected for further processing and the solid coconut product retained in the basket was removed from the basket. The solid coconut product obtained in this step was a third coconut concentrate having a fat content of 45 to 55%, based on the total weight of the coconut concentrate. The coconut concentrate was transferred into

30 the high speed cutting machine (ultra-precise cutting machine "Micro-Meister", manufactured by Masuko Sangyo). The third coconut concentrate was put through the high speed cutting machine to produce another coconut product, which in this case, was a spreadable coconut butter. The spreadable coconut butter has an average particle size of 29 microns. The spreadable coconut butter was collected and sent for

analysis. The contents of the spreadable coconut butter obtained in accordance with this process are shown in Table 1 below.

Example 3 - Concentrated Coconut Milk

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The filtrate consisting of a cloudy coconut oil of Example 2 was transferred into a high speed cutting machine (ultra-precise cutting machine "Micro-Meister", manufactured by Masuko Sangyo) to be further processed to reduce the size of any solid particles remain in the cloudy coconut oil. The resulting coconut product obtained was a concentrated coconut milk having an average particle size of 27 microns. The concentrated coconut milk has a fat content of 85 to 95%, based on the total weight of the concentrated coconut milk, and a fibre content of 1 to 15%, based on the total weight of the concentrated coconut milk. The concentrated coconut milk was collected and sent for analysis. The contents of the concentrated coconut milk obtained in accordance with this process are shown in Table 1 below.

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Example 4

Lab tests were carried out to determine the fat content, moisture content and the percentage of dietary fiber present in the three products produced in accordance with the process of the present invention. The results obtained are as follows:

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Test	Coconut Flour	Spreadable Coconut Butter	Concentrated Coconut Milk
Fat content (%w/w/)	29.8	51	88.5
Moisture Content (%w/w)	2.34	2.6	0.11
Total dietary fiber (%w/w)	27.6	18.4	2.1
Protein (%w/w)	16.8	11.7	-

25 The above is a description of the subject matter the inventors regard as the invention and is believed that those skilled in the art can and will design alternative embodiments that include of this invention as set forth in the following claims.

Claims:

1. A process of producing edible coconut products, the process comprising:
introducing desiccated coconut into a grinding apparatus;
5 grinding the desiccated coconut in the grinding apparatus to obtain a first coconut concentrate;
introducing the first coconut concentrate into a high speed cutting machine to further process the first coconut concentrate to obtain a second coconut concentrate;
and
10 subjecting the second coconut concentrate to centrifugation in a basket centrifuge at a speed of 500 to 3,000 rpm for a predetermined period of time to obtain a coconut product and a filtrate consisting of cloudy coconut oil.
2. The process according to claim 1, wherein the second coconut concentrate is
15 centrifuged in the basket centrifuge for 30 to 150 minutes to obtain the coconut product and the filtrate consisting of cloudy coconut oil.
3. The process according to claim 2, wherein the coconut product is coconut flour.
- 20 4. The process according to claim 3, wherein the coconut flour comprises 60 to 90% by weight of coconut fiber, based on the total weight of the coconut flour.
5. The process according to claim 4, wherein the coconut flour having an average
particle size of 5 to 400 microns, preferably 10 to 200 microns, and more preferably 10
25 to 65 microns.
6. The process according to claim 4, wherein the coconut flour having a fat content of 10 to 40% by weight, based on the total weight of the coconut flour.
- 30 7. The process according to claim 1, wherein the second coconut concentrate is centrifuged in the basket centrifuge for 3 to 10 minutes to obtain the coconut product and the filtrate consisting of cloudy coconut oil.

8. The process according to claim 7, wherein the coconut product is a third coconut concentrate.

9. The process according to claim 7 or 8, further comprising:

5 subjecting the coconut product or the third coconut concentrate to further processing in the high speed cutting machine to obtain a second coconut product, wherein the second coconut product is a spreadable coconut butter.

10 The process according to claim 9, wherein the spreadable coconut butter having
10 a fat content of 45 to 55% by weight, based on the total weight of the spreadable coconut butter, and an average particle size of 5 to 300 microns, preferably 10 to 150 microns, and more preferably 10 to 60 microns.

11 The process according to claim 10, wherein the spreadable coconut butter
15 comprises 45 to 55% by weight of coconut fiber, based on the total weight of the spreadable coconut butter.

12 The process according to claim 9, further comprising:
 storing the spreadable coconut butter in a table-top warming cabinet at a
20 temperature of 26°C and above for regular consumption.

13 The process according to claim 2 or 7, further comprising:
 passing the cloudy coconut oil through the high speed cutting machine to obtain
a third coconut product, wherein the third coconut product is a concentrated coconut
25 milk.

14 The process according to claim 13, wherein the concentrated coconut milk
having a fat content of 85 to 95% by weight, based on the total weight of the
concentrated coconut milk, and an average particle size of 5 to 200 microns, preferably
30 10 to 100 microns, and preferably 10 to 50 microns.

15 The process according to claim 14, wherein the concentrated coconut milk
comprises 5 to 15% by weight of coconut fiber, based on the total weight of the
concentrated coconut milk.

16. The process according to claim 13, further comprising:
storing the concentrated coconut milk in a table-top warming cabinet at a temperature of 26°C and above for regular consumption.

5 17. The process according to claim 1, wherein the desiccated coconut having a moisture content of 0.5 to 2.5% and a fat content of more than 60% by weight, based on the total weight of the desiccated coconut.

10 18. The process according to claim 1, wherein the basket centrifuge comprises a perforated basket lined with a filter cloth, with the filter cloth having perforations of 40 to 200 microns.

15 19. The process according to claim 1, wherein the first coconut concentrate is further processed in the high speed cutting machine to obtain the second coconut concentrate having an average particle size of 1 to 400 microns.