Title: PROCESS FOR PREPARING SHELF STABLE CUSTARD APPLE PULP AND POWDER

Abstract: The present invention deals with an organic process for preparing pulp from custard apple, which has an extended storage life of 12 months in a frozen state in acceptable conditions that can find use in various applications during non-availability of the fruit and a custard apple powder free of bitterness, discoloration and off-flavor that can be used in chilled beverages and ice creams. The process for preparing frozen custard apple pulp comprising mixing custard apple pulp with 0.05 to 0.15% ascorbic acid, filling in containers and blast freezing. The obtained pulp can also be mixed with milk powder, sugar candy, maltodextrin, tricalcium phosphate and honey, and spray dried.

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— with amended claims

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.
PROCESS FOR PREPARING SHELF STABLE CUSTARD APPLE PULP AND POWDER

TECHNICAL FIELD:
The present invention relates to a process for preparing shelf stable custard apple pulp and custard apple powder. The present invention deals with an organic process for preparing pulp from custard apple, which has an extended storage life of 12 months in a frozen state in acceptable conditions that can find use in various applications during non-availability of the fruit. The present invention also deals with an organic process for preparing custard apple powder free of bitterness, discoloration and off-flavor and that can be used in chilled beverages and ice creams.

BACKGROUND OF THE INVENTION:
The custard apple is a delicious tropical fruit. The white, creamy flesh has a strong aroma reminiscent of a mixture of strawberry, banana and pineapple. The fruits are generally eaten raw only when ripe, as heating alters the flavor. The fruits are highly perishable, and do not stay long after ripening. In view of seasonal availability and fast perishability of the fruit, a process for storage of good quality fruit pulp was attempted. During off-season, the stored pulp finds use in various applications like making ice cream, milk shakes, RTS beverages, nectar and so on.

In reference by Pardede et al., (1994) Food - Australia 46(5) : 205 - 206 wherein, treated custard apple pulp with 0.1% ascorbic acid can be stored up to 3 months in sealed nylon/LDPE bags at -16.3°C.

In another reference by Gamage et al., (1997) Journal of Food Processing and Preservation 21(4) : 289 - 301 wherein, storage life of 1 month was recorded for custard apple pulp when the pulp was treated with 0.1 - 0.5% ascorbic acid and stored in polyethylene bags at 0°C.

There however does not exist any prior art that teaches a process for preparing custard apple powder and no such product is available in the market.

OBJECTS OF THE INVENTION:
The main object of the present invention is to provide a process for the preparation of shelf-stable custard apple pulp

Another object of the present invention is to achieve the storage life of custard apple pulp in frozen form for as long a period as 12 months.
Yet another object is to achieve the storage life of custard apply pulp in organic state without the use of any chemical, other than ascorbic acid.

Still another object is to maintain the pulp in a form free of discoloration, off-flavor and development of bitterness, while use in thawed form.

One more object of the present invention is to provide a process for preparing custard apple powder that is free of bitterness, discoloration and off-flavor and that can be used in chilled beverages and ice creams.

SUMMARY OF THE INVENTION:
Accordingly, the present invention provides a process for preparing frozen custard apple pulp or spray dried custard apple powder free from bitterness, discoloration, and off-flavor, said process comprising of (a) ripening of mature custard apple fruits at 25 - 28°C to obtain sweet and flavored pulp, (b) scooping of pulp and separation of peel to exclude the grit cells, (c) passing through a pulper to obtain pulp, free of seeds (d) thorough mixing of pulp with 0.1% ascorbic acid (w/w), (e) immediate packing of pulp in 150 - 300 guage polyethylene bags after expelling air in unit packs, (f) sealing of polyethylene bags, (g) blast freezing the pulp in polyethylene bags and immediate storage at -20 to -30°C, (h) to obtain a frozen product that can have storage life of 12 months, free of discoloration, off-flavor and bitterness, when used for consumption, after thawing at room temperature, (i) mixing 50 to 60% by weight of the pulp thus obtained in step (b) or step (c) with 5 to 10 % by weight of milk powder, 5 to 10% by weight of sugar candy and 3-10% by weight of maltodextrin, 0.7 to 3.0% by weight of tricalcium phosphate, 1 to 3% by weight of honey and the remaining being water to bring the total soluble solids in the range of 35 to 40°Brix, and (j) spray drying the mixture of step (c) at an inlet temperature in the range of 100 to 140°C and an outlet temperature in the range of 70 to 110°C to obtain, spray dried custard apple powder.

DETAILED DESCRIPTION OF THE INVENTION:
Accordingly, the present invention provides a process for preparing frozen custard apple pulp or spray dried custard apple powder free from bitterness, discoloration, and off-flavor, said process comprising the steps of:

a. obtaining custard apple pulp;

b. mixing the pulp with 0.05 to 0.15% by weight of ascorbic acid;

c. optionally filling the mixture of step (b) in containers and blast freezing the same at temperature in the range of -10° to -50° C followed by immediately storing the
same at -15° C to -45° C to obtain frozen custard apple pulp;

d. mixing 50 to 60% by weight of the pulp thus obtained in step (b) or step (c) with 5 to 10% by weight of milk powder, 5 to 10% by weight of sugar candy and 3-10% by weight of maltodextrin, 0.7 to 3.0% by weight of tricalcium phosphate, 1 to 3% by weight of honey and the remaining being water to bring the total soluble solids in the range of 35 to 40°Brix, and

e. spray drying the mixture of step (c) at an inlet temperature in the range of 100 to 140°C and an outlet temperature in the range of 70 to 110°C to obtain spray dried custard apple powder.

In an embodiment of the present invention, the custard apple pulp is obtained from fresh ripe custard apple fruits.

In another embodiment of the present invention, the custard apple pulp is obtained by scooping the pulp from ripe fruits using a pulper followed by separating seeds from the same.

In yet another embodiment of the present invention, wherein in step (b), 0.1% by weight of ascorbic acid is mixed with the custard apple pulp.

In still another embodiment of the present invention, wherein the mixture obtained in step (c) is fast packed in polyethylene bags and sealed after expelling air.

In one more embodiment of the present invention, the sealed containers are blast freeze at temperature in the range of -20 degree C to -30 degree C.

In one another embodiment of the present invention, the frozen pulp is stored immediately at -20 degree C to -30 degree C.

In a further embodiment of the present invention, wherein in step (d), water is added to the mixture of step (d) to bring the total soluble solids to 38°Brix.

In a further more embodiment of the present invention, wherein prior to step (e), the mixture of step (d) is filtered through a fine sieve having mesh size in the range of 36 to 52.

In an embodiment of the present invention, wherein in step (e), the mixture of step (d) is spray dried at a flow rate of 40 to 80 ml/minute.

In another embodiment of the present invention, the freeze dried custard apple pulp thus obtained has a shelf life greater than about 12 months.

Accordingly, the present invention provides a process for preparing frozen custard apple pulp or spray dried custard apple powder free from bitterness, discoloration, and off-flavor,
said process comprising of (a) ripening of mature custard apple fruits at 25 - 28°C to obtain sweet and flavored pulp, (b) scooping of pulp and separation of peel to exclude the grit cells, (c) passing through a pulper to obtain pulp, free of seeds (d) thorough mixing of pulp with 0.1% ascorbic acid (w/w), (e) immediate packing of pulp in 150 - 300 guage polyethylene bags after expelling air in unit packs, (f) sealing of polyethylene bags, (g) blast freezing the pulp in polyethylene bags and immediate storage at -20 to -30°C, (h) to obtain a frozen product that can have storage life of 12 months, free of discoloration, off-flavor and bitterness, when used for consumption, after thawing at room temperature, (i) mixing 50 to 60% by weight of the pulp thus obtained in step (b) or step (c) with 5 to 10 % by weight of milk powder, 5 to 10% by weight of sugar candy and 3-10% by weight of maltodextrin, 0.7 to 3.0% by weight of tricalcium phosphate, 1 to 3% by weight of honey and the remaining being water to bring the total soluble solids in the range of 35 to 40°Brix, and (j) spray drying the mixture of step (c) at an inlet temperature in the range of 100 to 140°C and an outlet temperature in the range of 70 to 110°C to obtain spray dried custard apple powder.

The following examples are given by way of illustration of the present invention and its use for preparation of pulp or powder from custard apple, and therefore should not be construed to limit the scope of the present invention.

**EXAMPLE - 1**

The process entails selection of one hundred kg of mature custard apple fruits of specific gravity ~ 1, after ripening at 25 - 28°C, is subjected to separation of pulp from peel by scooping. Seeds from pulp is separated, after passing through a pulper. After mixing pulp with ascorbic acid @ 0.1% (w/w), the pulp is packed in 150 - 300 guage polyethylene (30 x 20 cm) bags, in 1 kg amounts, sealed. The packed pulp is immediately subjected to blast freezing to obtain pulp in uniform frozen state, at -20°C. The blast frozen pulp is immediately transferred for storage at -20 to -30°C. Throughout the process operations, for all washing purpose, potable water is used.

**EXAMPLE-2**

Pulp obtained from custard apple fruits procured from tropical and sub-tropical belts was used for frozen storage. Pulp from fruits of tropical climate were more sweet and flavored than sub-tropical lot. Both the lots, however, responded similarly to the storage life and storage quality, the operations detailed in experimental section.
EXAMPLE - 3

Pulp was subjected to blast freezing in 200, 500 and 1000 g quantities, before storing at -20 to -30°C. All the categories retained similar storage quality at the end of 12 months.

EXAMPLE - 4

The process entails extraction of pulp from mature ripe fruits by scooping and the seeds are separated using a pulper. The pulp (50%), is supplemented with milk powder (7%), sugar candy (7%) and maltodextrin (5%), tricalcium phosphate (1%) and honey (2%), on the basis of pulp weight. The supplemented pulp is diluted with water to final total soluble solids of 38°Brix, and passed through fine sieve. The entire feed material is then subjected to spray drying with an inlet temperature of 130°C that results in an outlet temperature of 100°C. The flow rate maintained at 70 ml per minute. The powder is collected and packed in airtight containers or sealed in unit laminated aluminum foil pouches.

EXAMPLE - 5

Pulp obtained from the mature ripe custard apple fruits was subjected to the preparation of spray dried powder. Pulp at 50% strength, was supplemented with milk powder (7%), sugar candy (7%), maltodextrin (5%), tricalcium phosphate (1%) and honey (2%), after diluting to a total soluble solids of 38°Brix was subjected to spray drying at an inlet temperature of 130°C with an outlet temperature of 100°C with a flow rate of 70 ml per minute. The powder tasted good when used in chilled RTS beverages/fruit based products.

EXAMPLE - 6

In this example, pulp from custard apple fruits procured from sub-tropical climate was subjected to spray drying. Other conditions were similar as in example 1. The powder was acceptable.

The novelty of the invention is as follows:

The process involves scooping of pulp from the peel with careful exclusion of grit cells. Immediate packing of de-seeded pulp in unit packs of polyethylene bags, followed by expelling of air and sealing, subject to fast freezing in a blast freezer serve to provide a shelf-stable frozen pulp with no change in viscosity.

The product is of organic quality. The process yields a microbiologically safe product, despite the long storage life, under the storage conditions specified. The frozen pulp when subjected to use in different forms as nectar, RTS etc., is similar to fresh pulp, free of problems of discoloration, development of bitterness and off-flavor.
Novelty of the invention shrouds around conditioning the supplementation of the custard apple pulp and operating the spray dried equipment, eventually to result in a free flowing product, that is free of bitterness, off-flavor and discoloration, particularly whilst used for consumption in chilled liquid or semisolid forms. As such no product is available in the market.

The main advantages of the present invention are:

1. Custard apple fruit can be stored in the form of frozen pulp for 12 months, till the beginning of the next season of fruit availability, so that any trade can proceed uninterruptedly.
2. The frozen pulp after thawing at room temperature can be used for preparation of various products, just like from the fresh fruit pulp.
3. The entire process does not involve the use of any heat or chemicals.
4. The problems imminent of processing viz., development of coloration, bitterness and off-flavor are not eventual.
5. The pulp in frozen form is microbiologically safe for consumption.
6. Spray dried powder serves to preserve custard apple fruits in dry form of extended storage life.
7. The product can serve the needs of populations bereft of custard apple production and in off-seasons.
8. The product is free from the problems of bitterness, development of off-flavor and discoloration, very characteristic of custard apple when processed.
9. No such product is available in the market.
10. The product in chilled beverage / ice cream form is pleasant to taste.
We claim:

1. A process for preparing frozen custard apple pulp or spray dried custard apple powder free from bitterness, discoloration, and off-flavor, said process comprising the steps of:
   a. obtaining custard apple pulp;
   b. mixing the pulp with 0.05 to 0.15% by weight of ascorbic acid;
   c. optionally filling the mixture of step (b) in containers and blast freezing the same at temperature in the range of -10 degree C to -50 degree C followed by immediately storing the same at -15 degree C to -45 degree C to obtain frozen custard apple pulp;
   d. mixing 50 to 60% by weight of the pulp thus obtained in step (b) or step (c) with 5 to 10% by weight of milk powder, 5 to 10% by weight of sugar candy and 3-10% by weight of maltodextrin, 0.7 to 3.0% by weight of tricalcium phosphate, 1 to 3% by weight of honey and the remaining being water to bring the total soluble solids in the range of 35 to 40° Brix, and
   e. spray drying the mixture of step (c) at an inlet temperature in the range of 100 to 140°C and an outlet temperature in the range of 70 to 110°C to obtain spray dried custard apple powder.

2. A process as claimed in claim 1, wherein the custard apple pulp is obtained from fresh ripe custard apple fruits.

3. A process as claimed in claim 2, wherein the custard apple pulp is obtained by scooping the pulp from ripe fruits using a pulper followed by separating seeds from the same.

4. A process as claimed in claim 1 wherein in step (b), 0.1% by weight of ascorbic acid is mixed with the custard apple pulp.

5. A process as claimed in claim 1 wherein the mixture obtained in step (c) is fast packed in polyethylene bags and sealed after expelling air.

6. A process as claimed in claim 1, wherein the sealed containers are blast freezeed at temperature in the range of -20 degree C to -30 degree C.

7. A process as claimed in claim 1, wherein the frozen pulp is stored immediately at -20 degree C to -30 degree C.

8. A process as claimed in claim 1 wherein in step (d), water is added to the mixture of step (d) to bring the total soluble solids to 38° Brix.
9. A process as claimed in claim 1 wherein in prior to step (e), the mixture of step (d) is filtered through a fine sieve having mesh size in the range of 36 to 52.

10. A process as claimed in claim 1 wherein in step (e), the mixture of step (d) is spray dried at a flow rate of 40 to 80 ml/minute.

11. A process as claimed in claim 1 wherein the freeze dried custard apple pulp thus obtained has a shelf life greater than about 12 months.
AMENDED CLAIMS
[received by the International Bureau on 30 March 2005 (30.03.05);
original claims 1-11 replaced by new claims 1-9 (1 page).]

1. A process for preparing spray dried custard apple powder free from bitterness,
discoloration, and off-flavor from custard pulp, said process comprising the steps of:
   a. obtaining custard apple pulp;
   b. mixing 50 to 60% by weight of the pulp thus obtained in step (a) with 5 to
      10% by weight of milk powder, 5 to 10% by weight of sugar candy and 3-
      10% by weight of maltodextrin, 0.7 to 3.0% by weight of tricalcium
      phosphate, 1 to 3% by weight of honey and the remaining being water to
      bring the total soluble solids in the range of 35 to 40°Brix, and
   c. spray drying the mixture of step (b) at an inlet temperature in the range of
      100 to 140°C and an outlet temperature in the range of 70 to 110°C to
      obtain spray dried custard apple powder.

2. A process as claimed in claim 1, wherein the custard apple pulp is obtained from
   fresh ripe custard apple fruits.

3. A process as claimed in claim 2, wherein the custard apple pulp is obtained by
   scooping the pulp from ripe fruits using a pulper followed by separating seeds
   from the same.

4. A process as claimed in claim 1, wherein step (a) the pulp is optionally mixed
   with 0.05-0.15% by weight of ascorbic acid.

5. A process as claimed in claim 4, 0.1% by weight of ascorbic acid is mixed with
   the custard apple pulp.

6. A process as claimed in claim 1 wherein in step (b), water is added to bring the
   total soluble solids to 38°Brix.

7. A process as claimed in claim 1 wherein in prior to step (c), the mixture of step
   (b) is filtered through a fine sieve having mesh size in the range of 36 to 52.

8. A process as claimed in claim 1 wherein in step (c), the mixture of step (b) is
   spray dried at a flow rate of 40 to 80 ml/minute.

9. spray dried custard apple powder free from bitterness, discoloration, and off-
   flavor obtained by the process as claimed in claim 1.
**INTERNATIONAL SEARCH REPORT**

**A. CLASSIFICATION OF SUBJECT MATTER**

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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)

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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 practical, search terms used)

EPO-Internal, WPI Data, PAJ, FSTA, BIOSIS

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

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Further documents are listed in the continuation of box C.

**Date of the actual completion of the International search**

7 September 2004

**Date of mailing of the International search report**

17/09/2004

**Name and mailing address of the ISA**

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**Authorized officer**

Boddaert, P
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<td>PARDEDE E ET AL: &quot;Control of browning during the thawing of custard apple pulp.&quot; FOOD AUSTRALIA 1994 CORRESPONDENCE (REPRINT) ADDRESS, K. A. BUCKLE, DEP. OF FOOD SCI. &amp; TECH., UNIV. OF NEW SOUTH WALES, PO BOX 1, KENSINGTON, NSW 2033, AUSTRALIA, vol. 46, no. 5, 1994, page 205, XP008034514 cited in the application abstract</td>
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