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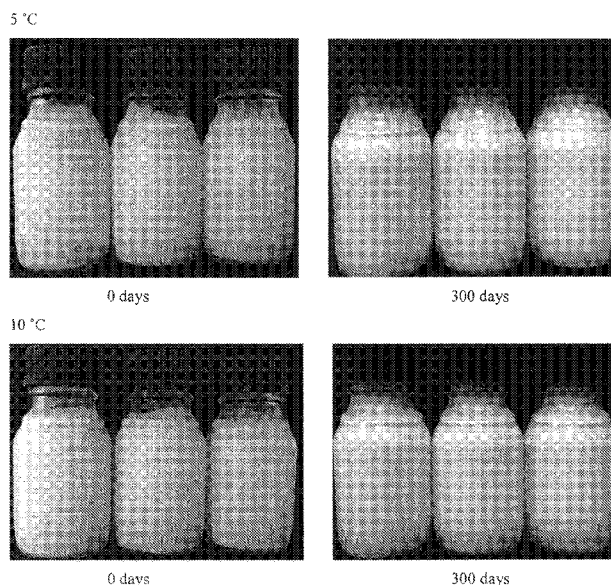
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Figure 3: Santan Sawit PLUS with (retort process technology) thermal treatment and preservative stored at various temperatures also show longer shelf life of 10 months.



(57) Abstract: The present invention relates to an improved process for producing, a palm-based liquid coconut milk substitute, producing an improved liquid coconut milk substitute with longer shelf stability at various temperatures.



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IMPROVED PALM-BASED LIQUID COCONUT MILK SUBSTITUTE WITH IMPROVED PROCESS

FIELD OF THE INVENTION

The present invention relates to an improved process for producing an improved palm-based liquid coconut milk substitute.

BACKGROUND OF THE INVENTION

In the past 10 years, coconut santan has triggered alarming issues pertaining to health. Coconut santan if taken in large quantities or frequently, is considered a bad food for health (Mensink and Kantan, 1992, Hayes et al., 1992) as more than 90% of its fatty acids are saturated, and mainly lauric (C12:0) and myristic (C14:0) which have been identified as risk factors in the development of a variety of lifestyle diseases, such as heart disease, certain cancers, obesity. Coconut milk contains a large proportion of lauric acid (C12:0) and myristic acid (C14:0), a saturated fat that raises total blood cholesterol levels by increasing the amount of low-density lipoprotein cholesterol (*Mensink et al., 2003; Jump et al., 2016*).

Thus, there is a need to formulate coconut santan substitute to obviate the health defects of coconut. Palm-based liquid coconut milk substitute (popularly referred to as "Santan sawit") was first introduced by Malaysian Palm Oil Board (MPOB) as a novel product in 2008 (TT 390). The santan sawit is a new agro-based research product is definitely the best alternative product to replace the traditional coconut santan. This product in the form of ready-to-use is gaining great demand in domestic market. Now, santan sawit is popular among the society and consumers and widely accessible in local retailers and hypermarkets such as Giant, Tesco and Mydin. Malaysian food especially Malay food, consumes high quantities of coconut santan which is rich in fat and has high content of saturated fatty acids. Notwithstanding the taste, santan has deleterious effect on human health due to its high levels of fatty acids.

Santan Sawit is comparable to coconut milk in taste and appearance. It has a variety of benefits, including low saturated fat content and more durable. Santan Sawit is rich in vitamin E, pro-vitamin A (carotenoid) and contains equal proportions of saturated and unsaturated fatty acids. Myristic acid (1%), stearic acid (5%) and palmitic acid (44%) make up the saturated fatty acid component in addition to monounsaturated oleic acid (39%) and polyunsaturated linoleic acid (11%) in Santan Sawit.

Saturated fat has been shown to have loads of positive effects on the body. Some human clinical studies have found that saturated fats do not create high cholesterol, do not contribute to heart disease, are not cancer-causing and do not clog arteries. In fact, saturated fats play many vital roles in the body to help strengthen the immune system, promote healthy bones, provide energy and structural integrity to the cells, protect the liver, and assist the body's metabolism of essential fatty acids. Studies also found that palm oil increases the good HDL cholesterol levels while having a neutral to beneficial effect on the bad LDL cholesterol levels, thus promoting cardiovascular health (De souza et al., 2015; Ong, 2002; Edem, 2002).

In 1998, Palm Oil Research Institute (PORIM) produced a palm-based coconut milk powder substitute in a powdered form using a spray drying technique which has been granted as Malaysian Patent no. MY-133041-A. Without water, it stored better, and had improved flavour and nutritive value, and enhanced stability and was easier to handle during storage and transport (Zaida et al., 1997. *Production and Characterization of palm-based santan powder*, PORIM Information Series No. 45).

In 2011, Malaysian Palm Oil Board (MPOB) filed a patent application (Malaysian patent application no. PI 2011005682) for an invention that relates to a palm-based liquid coconut milk substitute ("santan sawit"), to a formulation to make liquid coconut milk substitute and a method for preparing said liquid coconut milk substitute. However, the "santan sawit" can only remain stable with no odor developed for more than 20 days at temperatures 5°C, 10 °C and 15 °C. Further, it discloses that the "santan sawit" stayed fresh for more than 30 days without separation and deterioration at 5°C.

Zainal, Z. et al., "Palm-Based Trans-Free Liquid Santan", MPOB Information Series, June 2008, No. 390, (ISSN 1511-7871) states that palm-based liquid coconut milk substitute (palm Santan) is stable for 28 days without preservative at 5°C and 28°C.

5 Santan sawit has comparable price and sensory attributes than coconut santan. The product is relatively thick, which permits two times higher in cooking application than its counterpart. It is well-established that the santan sawit is not only enriched with vitamins A and E but also contains moderate levels of saturated fats when compared to coconut santan (Zaida et al., 2008). Moreover, the product is prone to oxidation upon storage. The product is remained
10 stable for almost one month when stored at ambient temperature, 25°C. Therefore, improved process need to be carry out on the previous innovation to increase the shelf life of the product and to meet the consumers' requirement.

Hereinafter said liquid coconut milk substitute produced by the improved process of the present
15 invention will also be referred to as "santan sawit plus".

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SUMMARY OF THE INVENTION

The present invention provides a process for producing a palm-based liquid coconut milk substitute comprising the steps of:

- 5 i. weighing the ingredients in group (A) comprising :
 - a. water
 - b. Sodium tripolyphosphate
 - c. Sodium Caseinate
- 10 ii. weighing the ingredients in group (B) comprising :
 - a. Palm-based oil
 - b. Emulsifier
 - c. Panodan
 - d. Coconut flavour
- 15 iii. mixing the ingredients in group (A) using a mixer at high speed until a water-based mixture is formed
- iv. melting the palm-based oil in group (B)
- v. mixing the oil-based ingredients of group (B) into the water-based mixture obtained from step iii slowly and continuously using the mixer until the mixture
- 20 of the oil-based and water-based ingredients are mixed well;
- vi. monitoring and recording the temperature of the mixture obtained from step v;
- vii. homogenizing the mixture obtained from step v using a homogenizer;
- viii. recording the temperature of the mixture again once the homogenization process is completed;
- 25 ix. storing the homogenized mixture from step vii in a chiller for one day
- x. processing the mixture using retort process technology;
- xi. storing the final product at any required temperature within a range of approximately 5°C to 30°C.
- 30 It is recommended that the homogenization process in step vii be carried out at a pressure within a range of 750bar to 850bar.

One of the preferred embodiments of the present invention is a process for producing a palm-based liquid coconut milk substitute, wherein the retort process technology in step x comprises the steps of:

- i. placing the mixture from step ix inside a container such as a retort pouch;
- ii. sealing the container, and then placing the container in a retort, which is a small industrial-scale pressure cooker;
- iii. sealing and heating the retort to a specific temperature, and further
- iv. heating the mixture for a specific length of time.

It is preferred that the optimum range of temperature for the retort processing is between 95°C to 110°C for 10 to 30 minutes.

The ingredients in group (A) may optionally further include a food preservative.

The food preservative is not limited to, but may be, one or more of the following:

- i. potassium sorbate
- ii. sodium benzoate

The process of the present invention is able to produce a palm-based liquid coconut milk substitute which has shelf life stability for more than 10 months without affecting its overall acceptability and stability and it is available in ready-to-use form. The "santan sawit plus" is stable at various temperatures including at 5°C, 10°C, 15°C, 20°C, 25°C, 27°C and 30°C. Furthermore, the "santan sawit plus" is rich in vitamin A, E and tocotrienol. The "santan sawit plus" resembles the similar taste as good as the coconut santan, liquid milk and it is a trans-free palm-based liquid coconut milk-substitute, and being produced using natural source of plants without preservatives. Foods prepared using "santan sawit plus" hardly turns rancid within a month.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1: The appearance of Santan Sawit versus Santan Sawit Plus after 15 days storage at 27°C. Santan Sawit Plus was retort for 25 minutes at 106°C).

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Figure 2: Santan Sawit Plus with improved process has longer shelf life of 10 months at various temperatures.

Figure 3: Santan Sawit Plus with (retort process technology) thermal treatment and preservative stored at various temperatures also show longer shelf life of 10 months.

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Figure 4: The sensory evaluation of Santan Sawit Plus from various aspects e.g. appearance, odour, taste, creamy and overall acceptance of Santan Sawit Plus as compared to those of the commercial Santan Sawit.

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Figure 5: The microbial study on Santan Sawit Plus for 1 month and 10 months storage at 27°C.

Figure 6: The microbial study on Santan Sawit and Santan Sawit Plus.

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Figure 7: Kinetic of transmission profiles

Figure 7(a): Transmission profiles at 2000 rpm of coconut santan, from the top of the cell (104mm) to the bottom (130mm) of the cell.

Figure 7(b): Transmission profiles at 2000 rpm of commercial santan sawit, from the top of the cell (104mm) to the bottom (130mm) of the cell.

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Figure 7(c) Transmission profiles at 2000 rpm of Santan Sawit Plus, from the top of the cell (104mm) to the bottom (130mm) of the cell.

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DETAILED DESCRIPTION OF THE INVENTION

In describing some of the preferred embodiments of the invention as may be illustrated in the drawings, specific terminologies will be resorted to for the sake of clarity. However, the invention is not intended to be limited to the specific terms so selected, and it is to be understood that each specific term includes all technical equivalents which operate in a similar manner to accomplish a similar purpose. The invention will now be further illustrated by way of the examples herein, which describe several embodiments of the invention.

The present invention provides an improved process to produce a "santan sawit plus" with longer shelf life stability and it is available in ready-to-use form at various temperatures (i.e. 5°C, 10°C, 15°C, 20°C, 25°C, 27°C, 30°C). The "santan sawit plus" resembles the similar taste as good as the coconut santan, liquid milk and it is a trans-free palm-based liquid coconut milk-substitute, and being produced using natural source of plants. Preservatives are not necessary but may optionally be used. It is a healthier product compared to coconut santan due to its lower contents of lauric acid and myristic acids and it is naturally rich in vitamin A, E and tocotrienol. Most importantly, "santan sawit plus" has a longer shelf life stability for more than 10 months without affecting its overall acceptability and stability. Foods prepared using "santan sawit plus" hardly turns rancid within a month.

The improved process producing the 'santan sawit plus' involves a cost-effective treatment, sterilization with and without the additions of preservatives. It is interesting to note that thermal sterilization does not only retain its sensory properties, but it is found that the "santan sawit plus" is microbiologically safe for more than 10 months at 27°C. Therefore, the "santan sawit plus" is stable prior to prolonged storage conditions without the need of refrigeration, and this ultimately allows the product to be marketed to overseas.

Nutritional Information

Table 1: Nutritional compositions of Santan Sawit PLUS, commercial Santan Sawit and Coconut mik (Santan)

Ingredients	Percentage (%)
Palm-based oil	20-35
Maltodextrin	5-10
Sodium Caseinate	1-2
Coconut flavour/without	0.1-0.2
Emulsifier	0.1-0.2
Sodium tripolyphosphate	0.1-0.2
Panodan	0.1 -0.05
Water	60-70
Total	100.00

Food Component	SantanSawitPLUS	Commercial SantanSawit	Coconut Santan
TOTAL FAT (g)	26.8	28.0	29.4
PROTEIN (g)	1.2	1.3	2.2
CARBOHYDRATES (g)	9.3	7.2	2.3
MOISTURE (g)	62.5	61.8	65.3
ASH (g)	0.2	0.3	2.1
CALORIES (kcal)	283	298	280
VITAMIN A (µg)	ND (<100)	ND (<100)	ND
VITAMIN E (mg) (total tocopherol and tocotrienol)	12.3	12.5	ND

* Amount per serving 100 g

* ND stands for not detected.

The higher amount of Vitamin E was detected in the Santan Sawit Plus and santan sawit commercial compared to coconut santan. Vitamin E is an important fat-soluble antioxidant compound that helps the body in neutralizing the dangerous after-effects of oxidation of fats. This vitamin acts in halting free-radical production, which is a main factor in preventing the development of chronic diseases and ageing. It is also an essential element in the total maintenance of a healthy immune system. Current studies have proven that vitamin E

especially palm tocotrienols role in preventing degenerative mental imbalances such as dementia and Alzheimer's disease (Gopalan et al., 2013). Palm oil contains higher amount of tocotrienols than tocopherols.

FORMULATIONS

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The formulation of Santan Sawit Plus is similar with the previous innovations on Santan Sawit which filed as Palm Based liquid coconut milk substitute at Malaysian Patent office under patent application no. PI 2011005682. The invention on the Palm Based liquid coconut milk substitute was filed on November, 2011.

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Ingredients	0.02%	0.05%	0.1%
	Percentage (%)	Percentage (%)	Percentage (%)
Palm-based oil	27.56	27.55	27.54
Maltodextrin	7.75	7.75	7.74
Sodium Caseinate	1.32	1.32	1.32
Coconut flavour	0.57	0.57	0.57
Emulsifier	0.16	0.16	0.16
Sodium tripolyphosphate	0.19	0.19	0.19
Panodan	0.038	0.038	0.038
Sodium Benzoate	0.02	0.05	0.1
Water	62.38	62.37	62.33
Total	99.99	100.00	99.99

Ingredients Group A

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- Water
- Sodium tripolyphosphate
- Without food preservatives/ with potassium sorbate) *Preservatives are not necessary but may optionally be used.
- Sodium Caseinate

Ingredients Group B

- Palm-based oil
- Emulsifier
- Panodan
- Coconut flavour

Methodology

The ingredients in group (A) and ingredients group (B) were weighted correctly. The ingredients in group (A) and in group (B) were mixed using a mixer at high speed (water-based). The palm-based oil was melted first before mix to the mixture. The oil-based ingredients were put into water-based slowly and continuously mixed using the mixer until the mixture ("santan sawit") is mixed well and its temperature was taken. The "santan sawit" was put into a homogenizer to homogenize it at 750bar to 850bar. The temperature of the "santan sawit" was recorded once the homogenization process is completed. Finally, the homogenized "santan sawit" was stored into a chiller for one day. It was then further used for the retort processing (improved process). The final product of "santan sawit PLUS" were kept in incubator at 5, 10, 15, 20, 25 and 25-30°C.

RETORT PROCESS TECHNOLOGY

The retort processing of Santan Sawit is a process of terminal thermal sterilization of food or a method of achieving commercially sterile Santan Sawit Plus. By using the retort process technology, Santan Sawit Plus can be made available for long time consumption without any harmful effects. This commercial sterility was the "degree of sterilization at which all pathogenic and toxin-forming organisms had been destroyed, as well as all other types of organisms grow in the Santan Sawit Plus and produce spoilage under normal handling and storage conditions.

The basic method for retorting a Santan Sawit Plus was placing the sample inside or a retort pouch, sealing the container, and then placing the container in a retort, which was a small industrial-scale pressure cooker. The retort was sealed and heated to a specific temperature, generally exceeding the boiling point of water. The Santan Sawit Plus was then heated for a specific length of time.

The processing time and temperature must be sufficient to render the Santan Sawit Plus commercially sterile. After cooking, the Santan Sawit Plus is cooled to room temperature. The severe heat treatment of retort processing can also destroy essential nutrients, negatively affect sensory properties and change the color of Santan Sawit Plus. Therefore, the optimum temperature was determined. In this study, the range of the temperature was between 95°C to 110°C for 10 to 30 minutes. The aim in choosing a processing temperature and time for a retorted Santan Sawit Plus is to maximize the quality retention and prevent overcooking, while maintaining the safety of the Santan Sawit Plus.

The length of processing time for retorted Santan Sawit Plus depends on the rate of heat transfer and on the dimensions of the package being processed. The smaller and thinner of the containers, the shorter the processing time required due to the shorter distance for heat transfer. In the processing of Santan Sawit Plus, the time used for the process is about 15, 20 and 25 minutes.

It can be seen in the picture below that the heat treatment processing with retort at 100 – 110°C for 10 - 30 minutes improve the quality of the Santan Sawit Pus. The Santan Sawit Plus easily undergoes deterioration without heat treatment processing. Santan Sawit Plus without heat treatment process has shorter shelf life and also the product curd separation occurred. While, santan sawit plus with heat treatment provide longer shelf life for the product to be stable without any phase separation.

Table 2: Storage stability of Santan Sawit Plus

Appearance and physical characteristics	
Storage condition	Initial – 10 months
5-27°C	• Off-white • Physically stable • Uniform emulsion • Smooth emulsion.

PRODUCT CHARACTERISTICS

Table 3: The product characteristics study on Santan Sawit Plus.

Retort Temperature (°C)	Time of retort process(min)	Preservative (%)	Without Preservative	Storage Temperature (°C)	Storage conditions
106	25	0.02% Potassium sorbate	-	• 5 • 10 • 15 • 20 • 25 • 27-30	Still stable More than 10 months
106	15	0.05% Potassium sorbate	-	• 5 • 10 • 15 • 20 • 25 • 27-30	Still stable more than 10 months
	20				
	25				
106	25	0.1% Potassium sorbate	-	• 5 • 10 • 15 • 20 • 25 • 27-30	Still stable more than 10 months
106	25	NIL (with retort)	With Retort	• 5 • 10 • 15 • 20 • 25 • 27-30	Still stable more than 10 months

STORAGE STABILITY

A. Storage stability for thermal treatment

The first characteristic evaluated was appearance, which is important for giving the initial impression and influencing subsequent judgments on the product. Based on the observation, Santan Sawit Plus at temperatures 5°C, 10°C, 15°C, 20°C, 25°C, 27°C, 30°C are stable with no color change or odor developed for more than 10 months compared to the previous santan sawit or coconut santan. Santan Sawit Plus stored at 5°C, 10°C, 15°C, 20°C, 25°C, 27°C as well as at ambient temperature from 1 month up to 10 months with thermal treatment (106°C, 25 minutes) still stayed fresh for more than 10 months without separation and deterioration as shown in the picture. The product is more stable at lower temperatures. Santan Sawit Plus stored at 5-10°C, therefore, it has very long shelf lives up to 2 years. It was limited by degradation of food quality and not bacterial contamination.

Table 4: Storage Stability Study of Santan Sawit Plus

Appearance and physical characteristics							
Storage condition	Initial	1 month	2 months	3 months	6 months	9 months	10 months
5 -27 °C	Off-white, Physically stable, uniform emulsion, smooth emulsion.	Off-white, Physically stable, uniform emulsion, smooth emulsion	Off-white, Physically stable, uniform emulsion, smooth emulsion	Off-white, Physically stable, uniform emulsion, smooth emulsion	Off-white, Physically stable, uniform emulsion, smooth emulsion	Off-white, Physically stable, uniform emulsion, smooth emulsion	Off-white, Physically stable, uniform emulsion, smooth emulsion

Storage stability

Santan Sawit Plus still stayed fresh for more than 10 months when stored at temperatures of 5°C, 10°C, 15°C, 20°C, 25°C, 27°C, 30°C without separation and deterioration as shown in the Figure 3.

Sensory properties

The sensory scores for appearance, odour, taste, creaming and overall acceptance of the commercial santan sawit (1 month storage) and Santan Sawit Plus (10 months storage) were rated and highly acceptable as shown in Figure 4. There was no significant difference between the commercial santan sawit (1 month storage) and Santan Sawit Plus (10 months storage).

Microbial study

The microbial study revealed that Santan Sawit Plus is microbiologically safe after 10 months storage at 27°C. *Escherichia coli*, *Salmonella spp.*, *Clostridium spp.*, *Staphylococcus spp.*, *Streptococci spp.*, yeast and mold were not detected during the 10 month storage.

Stability cycle

The stability cycle of santan was determined using Lumifuge 110. By utilizing centrifugal forces, it enables acceleration of the sedimentation of the dispersed particles to the bottom of the cell, leading to a clarification of the dispersion. Migration of particles or droplets was recorded during centrifugation using this stability analyzer. Data may be assessed in terms of stability behavior. The evolution (kinetics) of the demixing was documented by a sequence of the respective transmission profiles (transmission versus position within the sample) taken after selected time intervals (Ng et al., 2013). The stability cycle of a sample can be determined via the stability behaviour.

Kinetic of Transmission Profile Analysis

Figure 7 shows that the evolution of transmission profiles for three samples which were (a) coconut santan; (b) commercial santan sawit and (c) santan sawit Plus. All samples depicted the position of the interface immediately after the start of the centrifugation (10s) and the second profile (on the right) after 2542.65s of the centrifugation. For the first profile (on the

left) which is coconut santan, showed that the santan was not stable which shown high transmission starting on position 113mm. The high transmission indicate that the sedimentation start to form in coconut santan sample which indicate the high rate of clarification (22.71%/hour). While for commercial santan sawit shown that, during centrifugation, an increased in transmission was observed in the position 104mm and started to decrease. This showed that the early stage of centrifugation. The particles present at the position 111mm and above remained dispersed in the medium until reached in the position 126mm proven by the low value of transmission. The clarification of commercial santan showed lower than coconut santan which 1.7327% / hour. The thick profile starting from 127mm showed that the sample start to form sedimentation. On the other hand, the profile for santan sawit Plus, the particle was present in more stable stage compared to other two samples which is at 109mm which all particles remained dispersed until 127mm and only after that which is at the position 128mm the sedimentation starting to formed and had the lowest clarification velocity (0.5530%/hour). From the transmission profile and clarification rate showed that the santan sawit Plus that been stored for 300days as expected more stable compared to the commercial santan and coconut santan.

Colour determination

The colour of three different santan was determined using chromameter as presented in table 5. According to table 5, the Santan Sawit Plus has the lowest value of lightness (86.43) compared to the commercial santan and coconut santan which has higher value (96.40; 91.41). Other than that, the *a value shows that santan sawit plus with the lowest redness characteristic (0.17) and *b value shows that santan sawit plus with highest yellowness characteristic (6.22). This may influenced by the thermal treatment that been done to the santan sawit plus. However, the colour of santan sawit plus is considered acceptable for usage.

Table 5: The colour determination for three different santan (L*-Lightness, a*-red-greenness, b*-yellow-blueness)

Types of santan	*L	*a	*b
Commercial	96.40±0.0	-1.46±0.0	4.46±0.2
Sawit Plus	86.43±0.5	0.17±0.3	6.22±0.5
Coconut	91.41±0.3	-0.64±0.1	5.34±0.2

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INDUSTRIAL APPLICABILITY

The estimated total investment cost is RM 2,859,274. At production level of 1200,000 kg per annum and at a long-term price of RM 8.00 per kg, it will generate an income of RM 7,100,691 per year. The prospects in a Santan Sawit Plus are attractive with a payback period of two years.

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CLAIMS

1. A process for producing a palm-based liquid coconut milk substitute comprising the steps of:
- i. weighing the ingredients in group (A) comprising :
 - a. water
 - b. Sodium tripolyphosphate
 - c. Sodium Caseinate
 - ii. weighing the ingredients in group (B) comprising :
 - a. Palm-based oil
 - b. Emulsifier
 - c. Panodan
 - d. Coconut flavour
 - iii. mixing the ingredients in group (A) using a mixer at high speed until a water-based mixture is formed
 - iv. melting the palm-based oil in group (B)
 - v. mixing the oil-based ingredients of group (B) into the water-based mixture obtained from step iii slowly and continuously using the mixer until the mixture of the oil-based and water-based ingredients are mixed well;
 - vi. monitoring and recording the temperature of the mixture obtained from step v;
 - vii. homogenizing the mixture obtained from step v using a homogenizer;
 - viii. recording the temperature of the mixture again once the homogenization process is completed;
 - ix. storing the homogenized mixture from step vii in a chiller for one day;
 - x. processing the mixture using retort process technology;
 - xi. storing the final product at any required temperature within a range of approximately 5°C to 30°C.
2. A process for producing a palm-based liquid coconut milk substitute according to claim 1, wherein the homogenization process in step vii is at a pressure within a range of 750bar to 850bar.

3. A process for producing a palm-based liquid coconut milk substitute according to claim 1 or claim 2, wherein the retort process technology in step x comprises the steps of:
- v. placing the mixture from step ix inside a container such as a retort pouch;
 - vi. sealing the container, and then placing the container in a retort, which is a small industrial-scale pressure cooker;
 - vii. sealing and heating the retort to a specific temperature, and further
 - viii. heating the mixture for a specific length of time.
4. A process for producing a palm based liquid coconut milk substitute according to claim 3, wherein the optimum range of temperature for the retort processing is between 95°C to 110°C for 10 to 30 minutes.
5. A process for producing a palm based liquid coconut milk substitute according to any one of claims 1 to 4, wherein the ingredients in group (A) further includes a food preservative.
6. A process for producing a palm based liquid coconut milk substitute according to claim 5, wherein the food preservative comprises one or more of the following :
- iii. potassium sorbate
 - iv. sodium benzoate
7. A palm based liquid coconut milk substitute produced by a process according to any one of claims 1 to 6, wherein the "santan sawit plus" has shelf life stability for more than 10 months without affecting its overall acceptability and stability and it is available in ready-to-use form.
8. A palm based liquid coconut milk substitute produced by a process according to any one of claims 1 to 7, wherein the "santan sawit plus" is stable at various temperatures including at 5°C, 10°C, 15°C, 20°C, 25°C, 27°C and 30°C.

9. A palm based liquid coconut milk substitute produced by a process according to any one of claims 1 to 8, wherein the "santan sawit plus" is rich in vitamin A, E and tocotrienol.

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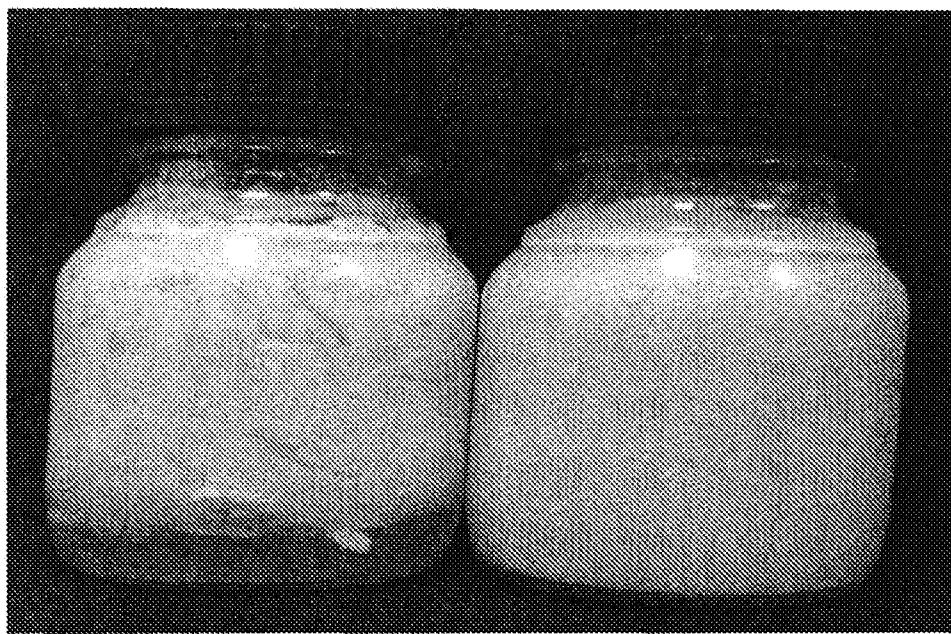
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Figure 1: The appearance of Santan Sawit versus Santan Sawit PLUS after 15 days storage at 27°C. Santan Sawit PLUS was retort for 25 minutes at 106°C).



Santan Sawit
without improved process

Santan Sawit
with improved process
(retort at 106°C for 25 minutes)
(Santan Sawit *PLUS*)

Figure 2: Santan Sawit PLUS with improved process has longer shelf life of 10 months at various temperatures.

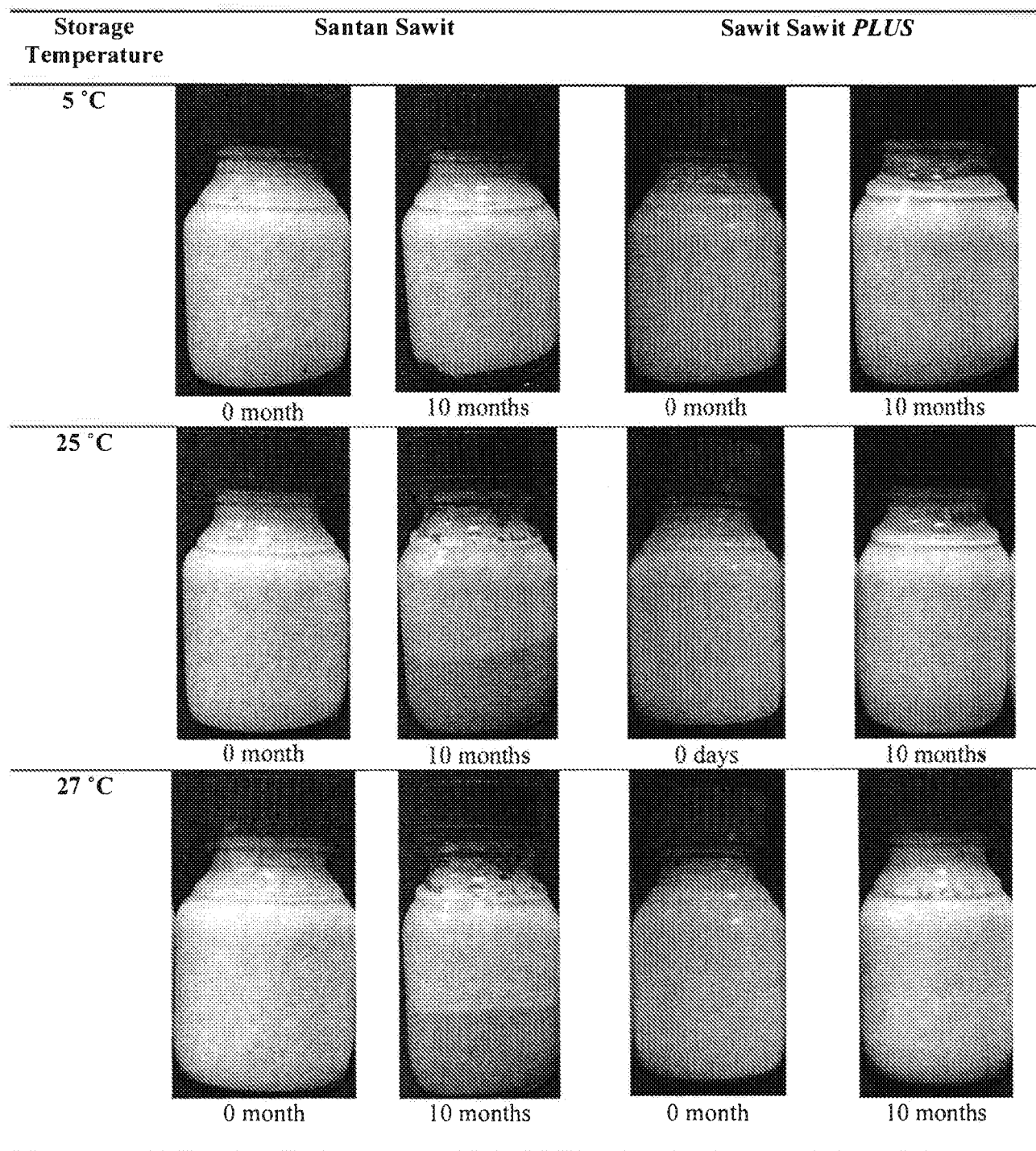


Figure 3: Santan Sawit PLUS with (retort process technology) thermal treatment and preservative stored at various temperatures also show longer shelf life of 10 months.

5 °C

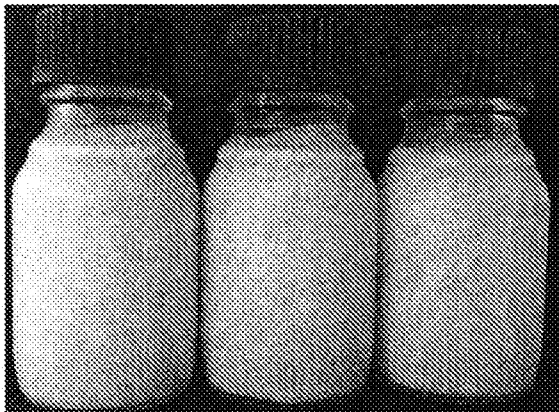


0 days

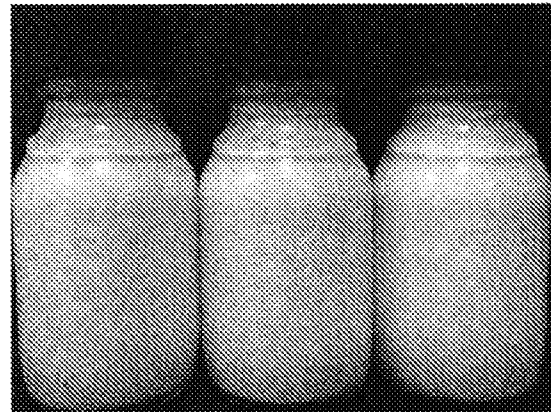


300 days

10 °C

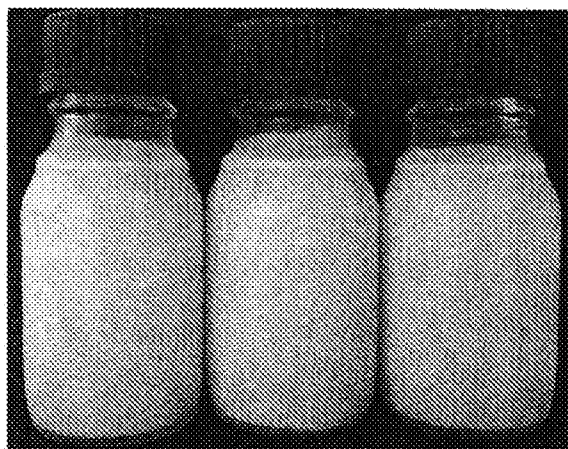


0 days



300 days

15 °C

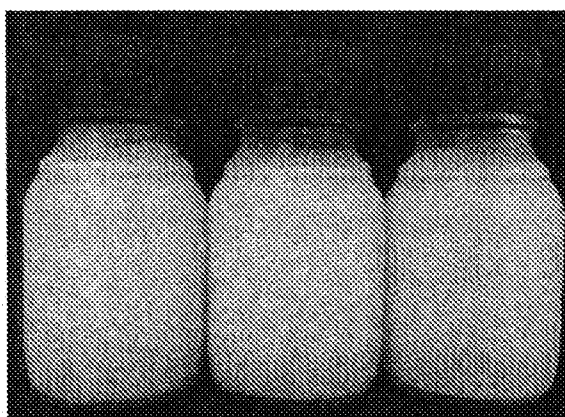


0 days



300 days

20 °C



0 days



300 days

25 °C

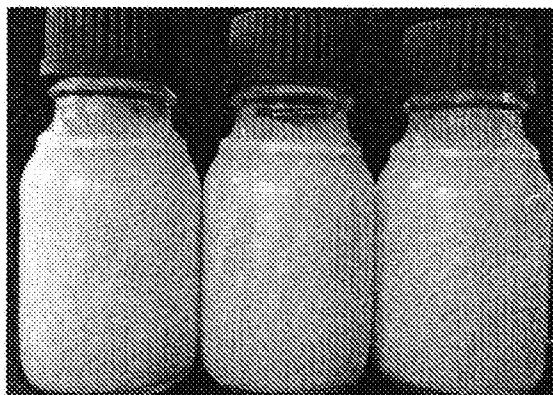


0 day

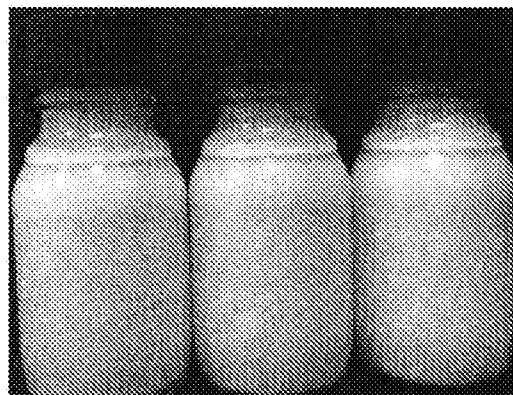


300 days

25-30 °C



0 day



300 days

Figure 4: The sensory evaluation of Santan Sawit Plus from various aspects e.g. appearance, odour, taste, creamy and overall acceptance of Santan Sawit Plus as compared to those of the commercial Santan Sawit.

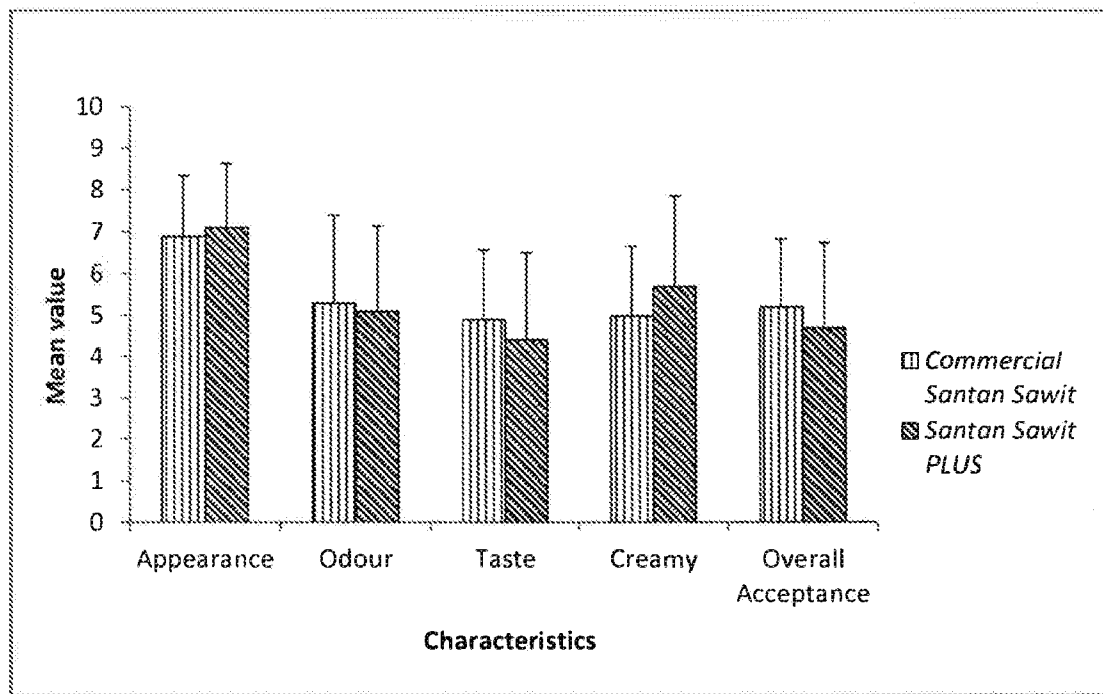


Figure 5: The microbial study on Santan Sawit Plus for 1 month and 10 months storage at 27°C.

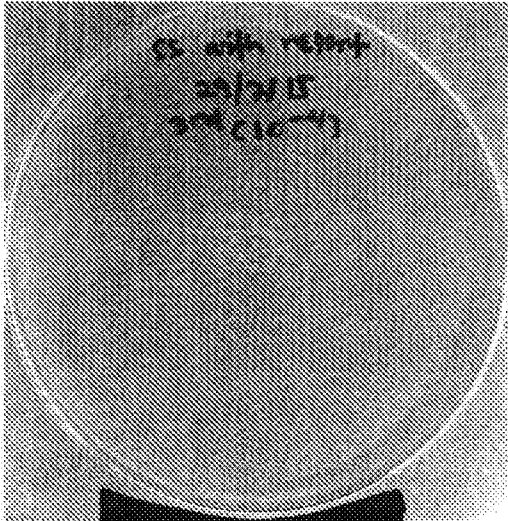


Plate 1 – Santan Sawit Plus with improved process at 1 month

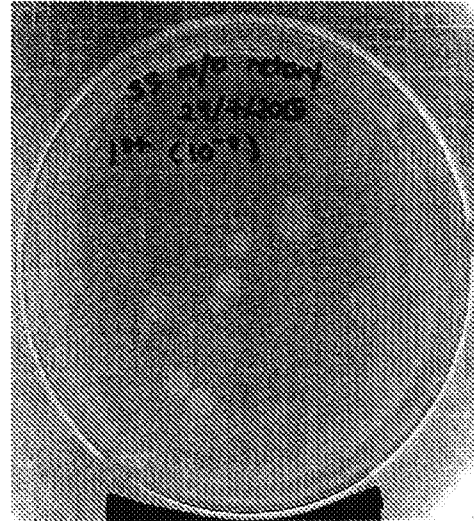


Plate 2 – Santan Sawit without improved process at 1 month

Figure 6: The microbial study on Santan Sawit and Santan Sawit Plus.

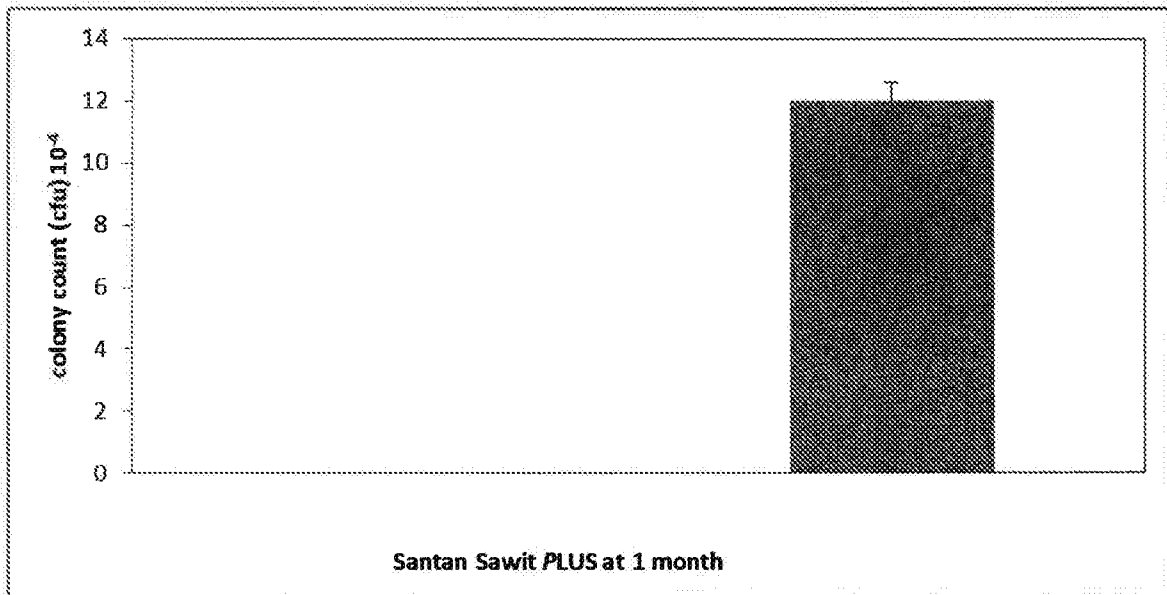


Figure 7: Kinetic of transmission profiles

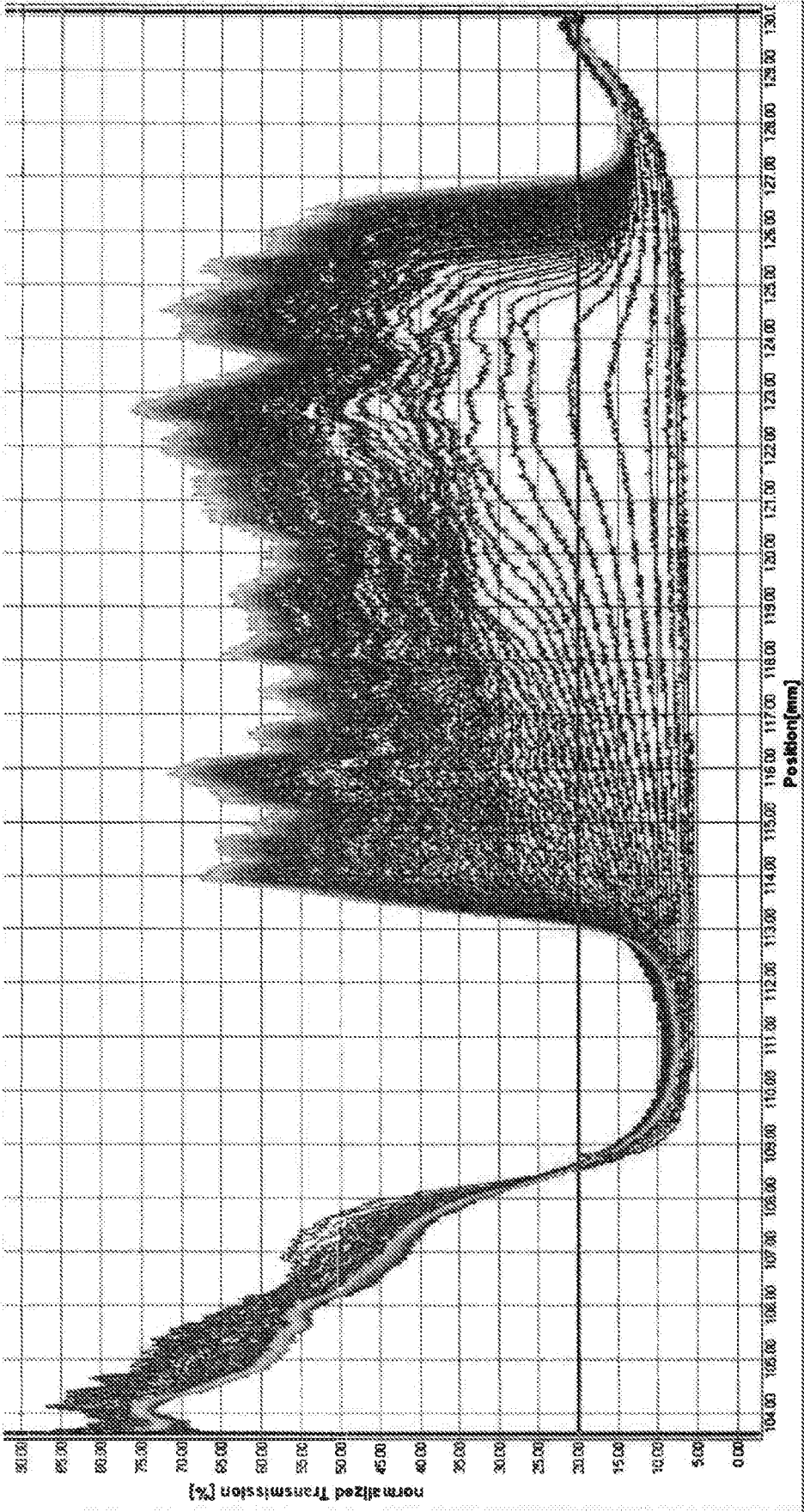


Figure 7(a): Transmission profiles at 2000 rpm of coconut santan, from the top of the cell (104mm) to the bottom (130mm) of the cell.

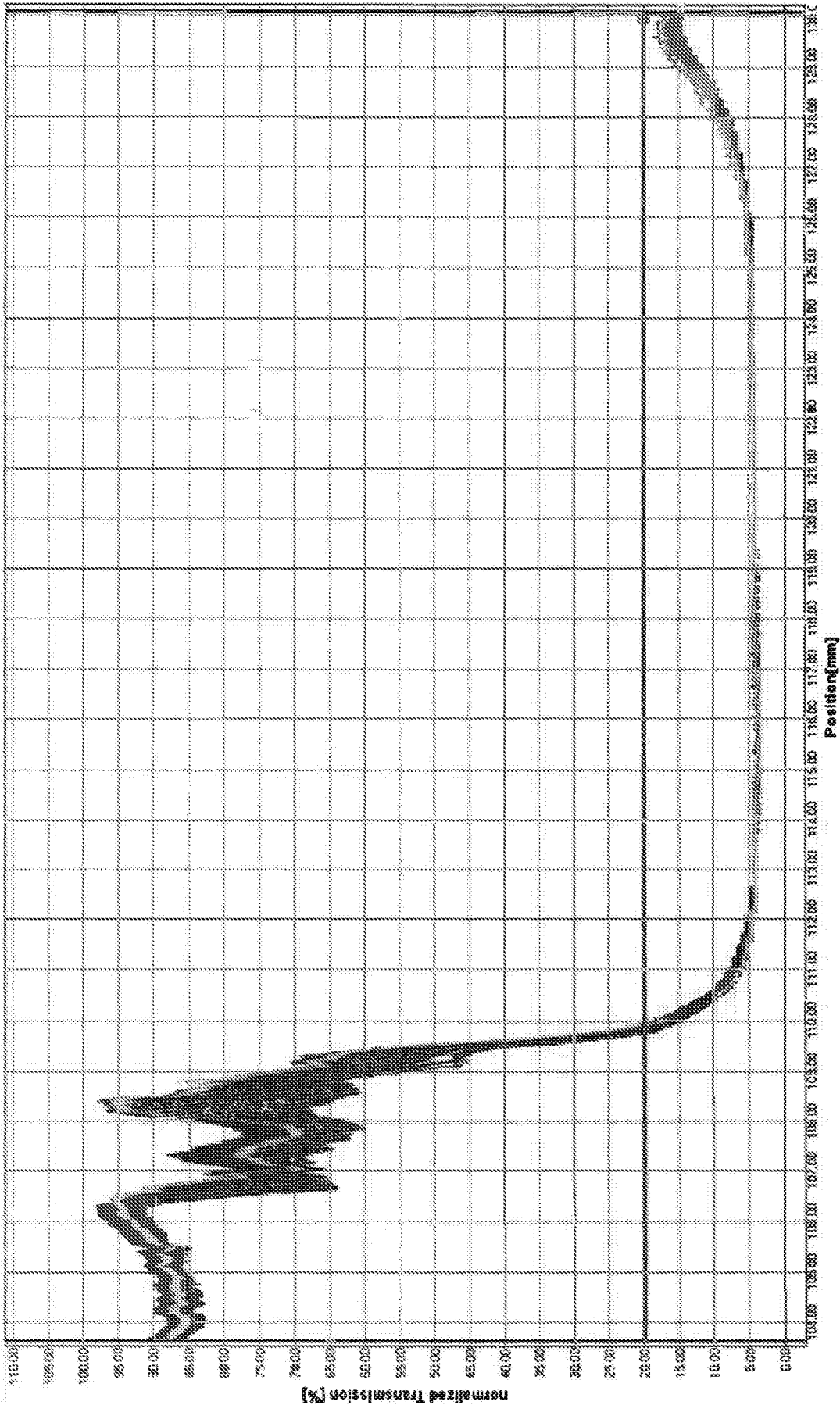


Figure 7(b): Transmission profiles at 2000 rpm of commercial santan sawit, from the top of the cell (104mm) to the bottom (130mm) of the cell.

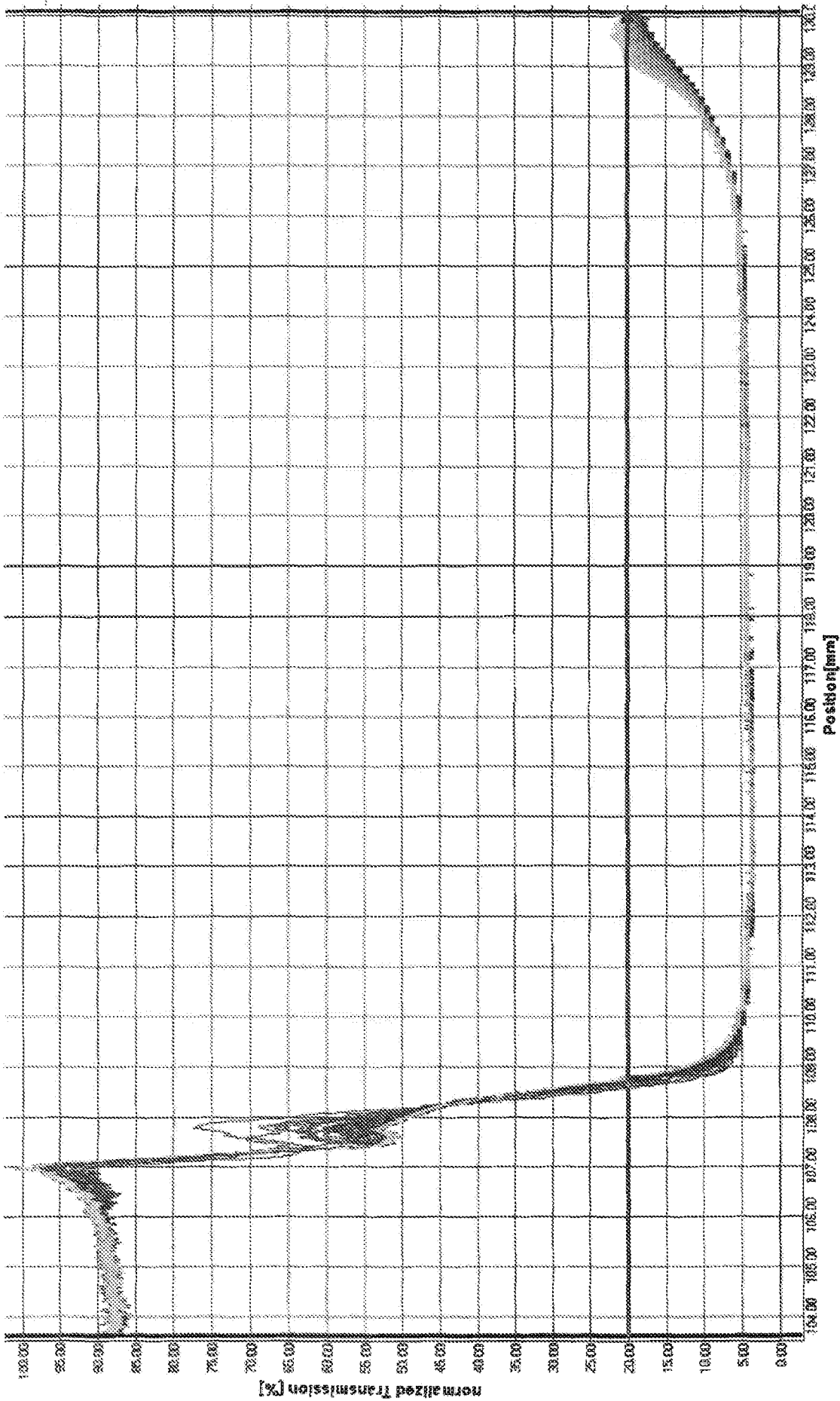


Figure 7(c): Transmission profiles at 2000 rpm of santan sawit Plus, from the top of the cell (104mm) to the bottom (130mm) of the cell.

INTERNATIONAL SEARCH REPORT

International application No.
PCT/MY2017/000020**A. CLASSIFICATION OF SUBJECT MATTER****A23C 11/06(2006.01)i, B01F 3/08(2006.01)i**

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

A23C 11/06; A23D 7/00; A23L 1/36; A23L 2/38; A23L 1/19; A23L 2/00; A23L 3/00; B01F 3/08

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Korean utility models and applications for utility models

Japanese utility models and applications for utility models

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

eKOMPASS(KIPO internal) & Keywords: coconut milk substitute, palm-based oil, sodium tripolyphosphate, codium caseinate, panodan, retort processing, homogenizer

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	WO 2013-077726 A2 (MALAYSIAN PALM OIL BOARD) 30 May 2013 See claim 19; and pages 7, 28-29.	1-4
Y	US 2008-0226794 A1 (BELL, ZENA et al.) 18 September 2008 See claim 1; and paragraph [0040].	1-4
A	US 5698254 A (CAMPBELL, IAIN JAMES et al.) 16 December 1997 See the whole document.	1-4
A	WO 98-19553 A1 (UNILEVER N.V. et al.) 14 May 1998 See the whole document.	1-4
A	JP 2008-099676 A (SANEI GEN FFI INC.) 01 May 2008 See the whole document.	1-4



Further documents are listed in the continuation of Box C.



See patent family annex.

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search

30 October 2017 (30.10.2017)

Date of mailing of the international search report

30 October 2017 (30.10.2017)

Name and mailing address of the ISA/KR

International Application Division

Korean Intellectual Property Office

189 Cheongsa-ro, Seo-gu, Daejeon, 35208, Republic of Korea

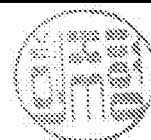


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INTERNATIONAL SEARCH REPORTInternational application No.
PCT/MY2017/000020**Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)**

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:
2. ☒ Claims Nos.: 6
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:
Claim 6 refers to an unsearchable claim which does not comply with PCT Rule 6.4(a).
3. ☒ Claims Nos.: 5, 7-9
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.
2. ☐ As all searchable claims could be searched without effort justifying an additional fees, this Authority did not invite payment of any additional fees.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:
4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.
- ☐ The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.
- ☐ No protest accompanied the payment of additional search fees.

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/MY2017/000020

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 2013-077726 A2	30/05/2013	WO 2013-077726 A3	18/07/2013
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WO 98-19553 A1	14/05/1998	AU 5313898 A MY 129404 A	29/05/1998 30/03/2007
JP 2008-099676 A	01/05/2008	None	