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***RESEARCH ARTICLE***

# DEVELOPMENT OF NATA DE COCO AND STRAWBERRY FLAVORED NATA DE COCO DRINK AND COMPARATIVE QUALITY EVALUATION

**Tajnuba Sharmin[a*], Neaj Ahmed[b]**

*[a]Assistant Professor, Department of Food Engineering, NPI University of Bangladesh, Manikjgonj*
*[b]B.Sc in Food and Process Engineering, Hajee Mohammad Danesh Science and Technology University*
*[*]Corresponding Author Email: itstajnuba@gmail.com*



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**ABSTRACT**

Nata de coco is a complementary treat of beverages made from coconut milk or water which was fermented by *Acetobacter Xylinum* bacteria. Although most nata are generally made with coconut milk or water, nata de coco can be made using other ingredients such as coconut milk, molasses or molasses, and other juices such as melons, pineapples, oranges, bananas, guavas, strawberries etc. This study was undertaken to design, construct and develop a new Strawberry flavored Nata De Coco and Nata De Coco drink and its comparative quality assessment respect to comparative quality evaluation of Nata De Coco drink. Best quality Nata De Coco were obtained by using 71.34% water, 13% Sugar, 15% Nata De Coco, 0.03% Gellan Gum, 0.06% Sodium Citrate, 0.12% Calcium Lactate, 0.01% Ascorbic Acid, 0.03% Potassium Sorbate, 0.012% Sodium Benzoate, 0.12%,Strawberry Flavor, 0.23% Citric Acid Anhydrous, 0.05% Liquid Cap. Overall analysis shows that Nata De coco Drinks which are produced with 15% Nata De Coco shows the best results and for other parameters results are respectively 0.23%, 0.0144 acidity; 13 ± 0.2 °Brix and pH 3.6± 0.1. As per evaluation of three samples, average value of taste of sample S3 is accepted. Because we used less citric acid in S1, more less citric acid in S3. Taste of S3 is accepted because taste quality of S1 & S2 is not perfect as per standard. Flavor of sample S3 is better than S1 & S3.Organoleptic test of S3 is better than S1 & S2. At the end of all evaluation, S3 is accepted for manufacturing. Because it is tasted well among the samples are made.

**KEYWORDS**

*Nata De Coco, Acetobacter Xylinum, coconut*

## 1. INTRODUCTION

### 1.1 Background

Nata de coco is one of several coconut water potential that most developed in Indonesia. Nata de coco is a result of coconut water fermentation by using the *Acetobacter Xylinum* bacteria. Chemically, the fiber contained in nata de coco is a cellulose fiber, known as bacterial cellulose (Piluharto et al., 2003). Bacterial celluloses have some advantages such as having a high purity without lignin, pectin, and hemicelluloses, which are commonly found in plant cellulose (Makoto et al., 2005).

Besides that cellulose fibers or nata de coco fiber produced by *Acetobacter Xylinum* has certain physical properties which different from plant cellulose (Yano et al., 2008). The unique physical properties of cellulose derived from this bacteria is having a high purity, crystalline, mechanical strength, and porosity, and also having quite enough capacity to absorb water and easy to get break down (Makoto et al., 2005). This makes nata de coco fiber potentially to be developed further not only as ingredients of processed foods or beverages, but also can be used for important industries such as manufacturing of the transducer diaphragm for speakers and headphones, artificial skin to replace skin damaged by fire, membrane separation, mixing materials in paper industry, producing carbon films electro-conductive, and materials for biomedical purposes (Watanabe et al., 1995; Iguchi et al., 2000; Ichikawa et al., 2005; Nakagaito et al., 2005; Fontana et al., 1990; Takai et al., 1994; George et al., 2005; Shibazaki, et al., 1994; Mormino and Bungay, 2003; Serafica et al., 2002; Schumann et al., 2009; Yoshino et al., 1991).

Based on the physical and mechanical properties of nata de coco fibers, it required a study about the use of cellulose fibers to be used as the basic material of natural fibers which can be used as new composite materials for the manufacture of other products such as prepack board motor or body of car, bullet resistant panels, roof frame, helicopter seat, and etc. In the application for the basic ingredients of such products, nata de coco fiber should have the advantage, both physical properties such as high fiber thickness and density and also mechanical properties such as high young modulus and tensile strength (Nakagaito et al., 2005).

Nata de coco also known as "coconut gel" is a chewy, translucent, jelly-like food produced by the fermentation of coconut water or coconut milk, which gels through the production of microbial cellulose by *Aeibacter Xylinus*. Originating in the small town namely Malvar, *Nata De Coco* is most commonly sweetened as a candy or dessert, and can accompany a variety of foods, including pickles, drinks, ice cream, puddings, and fruit cocktails. *Nata De Coco* was first created in 1973 in the Philippines by attempting to preserve coconut water as a jelly-like substance. Its name comes from the Spanish term of the same name and means "cream of coconut" or "coconut milk-skin". In the 20th century, the demand for coconuts increased. Products from coconuts became a major export product of the Philippines, including *Nata De Coco*.

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*Nata De Coco* is mainly made from coconut water, so it has a modest nutritional profile. One cup of it (118 grams) contains 109 calories, 1 gram of protein, and 7 grams of carbohydrates. It is often characterized as healthful since it contains dietary fiber to aid digestion while carrying fewer calories compared to other desserts, gram for gram.

Commercially made *Nata De Coco was* made by small farms in Thailand, Malaysia, and the Philippines, especially in Laguna and Quezon, and Indonesia, especially in the Special Region of Yogyakarta. It is commonly sold in jars.

*Nata De Coco* can be consumed on its own, but it can be used as an ingredient as well for fruit salads, *halo-halo*, coconut cakes, ice creams, soft drinks, bubble tea, and yoghurts.

Demand for Nata De Coco Drink is growing as more young people and school going children. The Nata De Coco Drink is a ready to drink beverage product prepared from different recipe with used Citric Acid and Sugar for reducing pH of the products.

### 1.2 Problem Statement and Justification of the study

During mixing of gellan gum need to mixing properly otherwise some coagulation happen in Nata De Coco Drink. In the time of homogenization step need to maintain homogenization pressure properly otherwise also can be happen coagulation. During pasteurization step need to maintain pasteurization temperature properly other than it will effect on Nata De Coco Drink shelf life. In the stage filling need to maintain the filling temperature, rinsing of bottles and capping every bottles properly otherwise it will also effect on the shelf life of the Nata De Coco Drink and create consumer complain any time. This gives considerable savings in energy and improved quality and production safely.

### 1.3 Objective

1. To Produce Nata De Coco with Strawberry flavor.
2. To improve the taste of Nata De Coco Drink.
3. To analyze the different parameters of Nata De Coco Drink.
4. Comparative quality evaluation of Nata De Coco Drink.

## 2. Meterials and Methods

### 2.1 Sample Collection

Coconuts were purchased from commercial market. The other ingredients were purchased from local market and abroad keeping the same specification for all experiments. Reverse osmosis water was used for all analysis. Polypropylene bags, Aluminum foil paper and standard grade chemicals were also used

### 2.2 Material

**Table 1:** Nata De Coco Initial formula

| Ingredients | Amount | Unit |
|---|---|---|
| RO water | 70.0 | liter |
| Raw Sugar | 6.0 | Kg |
| Raw Coconut | 3.00 | Kg |
| Acetic Acid | 1.60 | Kg |
| Mother Liquor | 20.000 | Kg |
| **Total** | **100.6** | **Liter** |

**Table 2:** Nata De Coco Final formula

| Ingredients | Amount | Unit |
|---|---|---|
| RO water | 30.0 | Liter |
| Sugar | 14.0 | Kg |
| Cube Nata | 70.00 | Kg |
| Citric Acid | 0.04 | Kg |
| Sodium Benzoate | 0.045 | Kg |
| Sodium Meta Bi Sulphate | 0.03 | Kg |
| Strawberry Flavor | 0.150 | Liter |
| **Total** | **114.3** | **Liter** |

**Table 3:** Nata De Coco Drink formula

| Ingredients | Amount | Unit |
|---|---|---|
| Sugar | 560 | Kg |
| Gellan Gum | 2.8 | Kg |
| Sodium Citrate | 2.4 | Kg |
| Calcium Lactate | 4.8 | Kg |
| Ascorbic Acid | 0.4 | Kg |
| Potassium Sorbate | 1.2 | Kg |
| Sodium Benzoate | 0.48 | Kg |
| Strawberry Flavor | 2.0 | Kg |
| Citric Acid Anhydrous | 9.2 | Kg |
| Liquid Cap | 1.6 | Kg |
| Nata De Coco | 600 | Kg |
| Water | 2816.00 | Kg |
| **Total** | **4000** | **Liter** |

**Sample 01**

Sugar – 11%
Gellan Gum – 0.03%
Sodium Citrate – 0.06%
Calcium Lactate – 0.12%
Ascorbic Acid – 0.12%
Potassium Sorbate – 0.03%
Sodium Benzoate – 0.012%
Strawberry Flavor – 0.12 %
Citric Acid – 0.18%
Liquid Cap– 0.05%
Treated Water – 73.39%

**Sample 2**

Sugar – 12%
Gellan Gum – 0.03%
Sodium Citrate – 0.06%
Calcium Lactate – 0.12%
Ascorbic Acid – 0.12%
Potassium Sorbate – 0.03%
Sodium Benzoate – 0.012%
Strawberry Flavor – 0.12 %
Citric Acid – 0.216%
Liquid Cap– 0.05%
Treated Water – 72.35%

**Sample 3**

Sugar – 13%
Gellan Gum – 0.03%
Sodium Citrate – 0.06%
Calcium Lactate – 0.12%
Ascorbic Acid – 0.12%
Potassium Sorbate – 0.03%
Sodium Benzoate – 0.012%
Strawberry Flavor – 0.12 %
Citric Acid – 0.23%
Liquid Cap– 0.05%
Treated Water – 73.34%

### 2.3 Methods of Nata De Coco manufacturing

Firstly, the pre-matured coconut was collected from various regions in our country. A manual machine was used for peel out the coconut. After peeled out the coconut then shell of the coconut was cut. Coconut milk was extracted from coconut. Others ingredients were measured as per ratio and all the ingredients were mixed properly. After mixing it was poured into tray and fermented at 37-38°C for 7 days. In this condition this sample

kept on 7 days for proper fermentation. After 7 days of fermentation the Nata was collected from the incubation chamber.

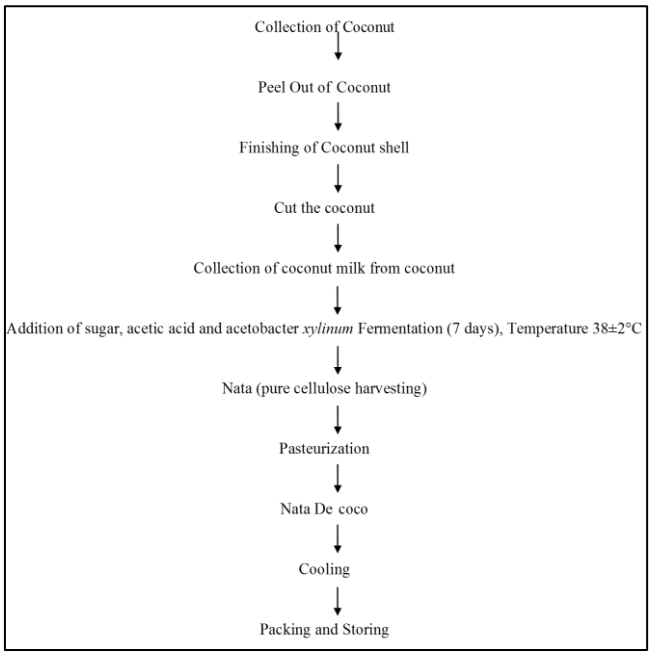


**Figure 1:** Flow chart of Nata De Coco Manufacturing

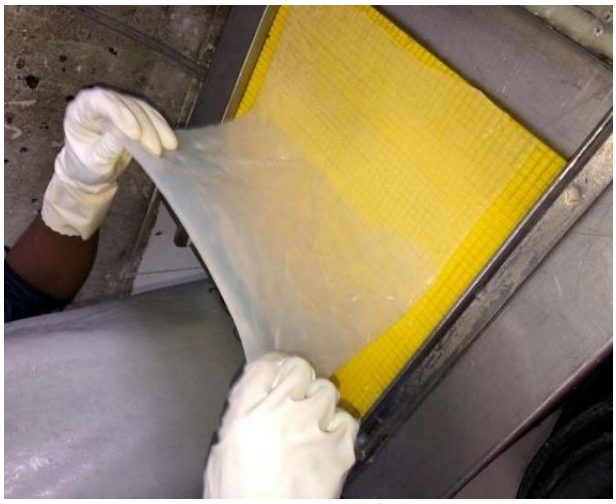

**Figure 2:** Pure Nata after harvesting

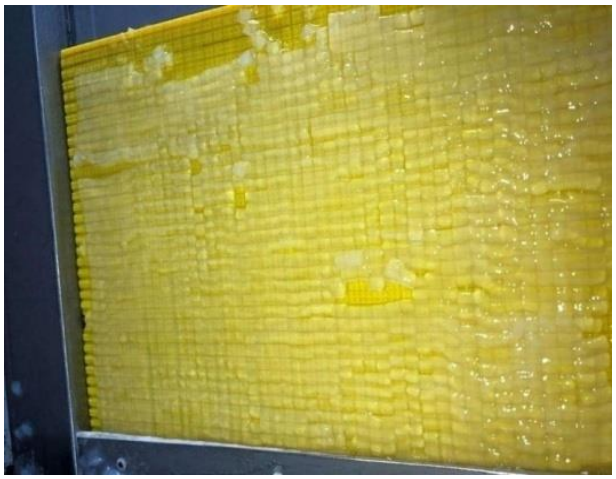

**Figure 3:** Cube Nata De Coco

Nata De Coco was cut into pieces 5×5×5 mm size. After cutting then the nata de coco was washed for removing the acid, then pasteurized the Nata de coco at 98±2°C for 15 – 30 sec.

The Nata De Coco was collected after pasteurization. The product was cooled below 40°C. Then the product was packed in poly bag, plastic drum and kept at 30 – 35°C temperature.

**Figure 4:** Nata De Coco

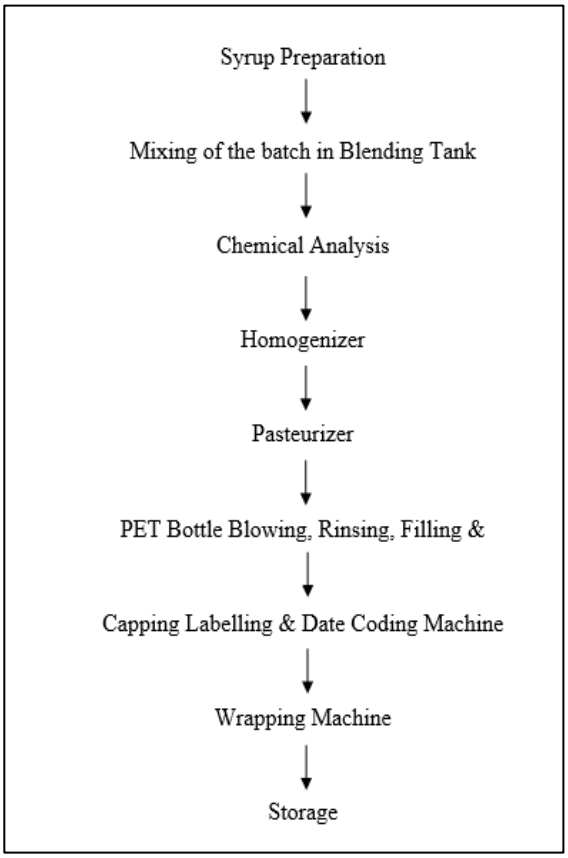


**Figure 5:** Flow Chart of Nata De Coco Drink

## 2.4 Methods

### *2.4.1 Syrup Preparation*

To prepare Nata De Coco Drink, needs to prepare syrup by mixing sugar with hot water and filtered after dissolve the sugar syrup. Syrup was stored separately into another storage tank below 30°C for further use.

### *2.4.2 Mixing Batch in Blending Tank*

In this stage nata de coco Drink was prepared with additional ingredients like sugar syrup, gellan gum, ascorbic acid, citric acid, sodium citrate, calcium lactate, potassium sorbate, sodium benzoate, neutral cloud and litchi flavor. In addition, the ingredients were took away from blending tank to another tank for mixing with Nata De Coco.

### *2.4.3 Chemical Analysis*

Chemical analysis such as °Brix, pH, Acidity was checked in this stage. It was done within two stage-Initial check and Final check. After confirming all the quality parameter then it was transferred to pasteurization balance tank.

### *2.4.4 Homogenization*

Homogenization was done to mix perfectly all the ingredients. All the particles were mixed homogeneously in this step. Homogenization pressure required 180 to 200 bar.

#### 2.4.5 Pasteurization

Pasteurization is the process to kill all the pathogenic microorganism present in Nata De Coco Drink. Pasteurization temperature was 98±2°C.

#### 2.4.6 PET Bottle blowing, Rinse, Filling and Capping

In this stage the bottles were collected from bottle blowing area through air conveyor. After that the bottles were rinsed properly. Then the Nata De Coco drink was pasteurized and filled into the bottle, filling temperature was maintained 74±20C. Generally, Nata De Coco Drink is filling with PET bottles. Then immediately capping the bottles after filling.

#### 2.4.7 Labeling and Date Coding

After completing filling then passed through cooling tunnel where the temperature was maintained below 40°C temperature. And then labeling was done in each bottle. Then date coding was provided as per shelf life of the products.

#### 2.4.8 Wrapping

When all bottles labeling is done then wrapping was done.

#### 2.4.9 Storage

Relative humidity and temperature are two most important environmental parameters that affect product quality. These two parameters can also affect the amount of the volatile substance of the drinks absorbed by the packaging material and consequently affect the shelf life of the product.

### 2.5 Proximate Analysis

#### 2.5.1 Acidity

Acidity was determined using titration method. We add the standard solution from a calibrated glass tube called a burette. In this experiment, phenolphthalein was used as an indicator when titrated Nata De coco or Nata De Coco Drink with NaOH solution. Phenolphthalein is a complex organic dye that is colourless in acidic solutions and pink in solutions that are slightly alkaline, or basic.

10 ml juice was taken as sample into a conical flask. 2-3 drops of phenolphtheline was added into it. Then titrated with the 0.225 N NaOH solution. Thus, acid value was determined using the equation of titration.

$$\frac{\text{Burette reading} \times \text{Normality of alkali} \times \text{Equivalent weight of Acid} \times 100}{\text{Volume of Sample} \times 1000}$$

#### 2.5.2 °Brix

At first sample was placed between a measuring prism and a small cover plate. Light traveling through the sample is either passed through to the reticle or totally internally reflected. Then observe oBrix reading through the eye piece at 20oc. Thus determine the oBrix content of Nata De Coco or Nata De coco Drinks.

#### 2.5.3 pH

Acidic solutions have a lower pH, while basic solutions have a higher pH. At room temperature, pure water is neither acidic nor basic and has a pH of 7. Before using a pH probe and meter to test pH, test the meter in a substance with a known pH rating to calibrate it. Before performing your main pH test, rinse the probe and meter with clean water and dry with a clean tissue. Collect the sample in a clean container that is deep enough to cover the tip of the probe. Use a thermometer to check the temperature of the sample, and then adjust the meter to match the sample temperature. This is an important step because the temperature of the water affects the sensitivity of the probe. Insert the probe into the sample and wait for the measurement to become steady, which indicates the meter has reached equilibrium.

#### 2.5.4 Sensory Evaluation of Nata De Coco Drink

For sensory evaluation of sensory data three different types of Nata De Coco Drink evaluated for color, flavor, odor, taste and overall acceptability by a panel of 10 testers. The panelists were briefed before evaluation. Three types of Nata De Coco were presented as randomly coded sample to the 10 panelists. The test panelists were asked to rate the different Nata De Coco Drink presented to them on a 9 point hedonic scale with the ratings of: 9 = Like extremely; 8 = Like very much; 7 = Like moderately; 6 = Like slightly; 5 = Neither like nor dislike; 4 = Dislike slightly; 3 = Dislike moderately; 2 = Dislike very much and 1 = Dislike extremely.

**Figure 6:** Nata De Coco Drink

## 3. Results and Discussion

The quality of Nata De Coco Drink depends on quality of Nata De Coco, Sugar and Citric acid because these are essential ingredients. One of the most important characteristics of the Citric acid and Sugar is purity. Purity of Citric acid and Sugar depends on moisture content of these ingredients and storage conditions. Table 4.1 represents the initial chemical analysis of sugar and citric acid for Nata De Coco drinks.

**Table 4:** Initial Chemical analysis of Sugar & Citric Acid

| Chemical Composition | Sugar |
|---|---|
| Moisture (%) | 0.35 |
| pH value (5% Solution) | 6.5 |
| Purity (%) | 99.9 |

| Chemical Composition | Citric Acid |
|---|---|
| Moisture (%) | 0.35 |
| pH value (2% Solution) | 1.85 |
| Purity (%) | 99.9 |

### 3.1 Chemical Analysis

The proximate chemical composition of Nata De Coco Drink samples (°Brix, Acidiy & pH) was determined using the method of AOAC (2005).Chemical composition of the prepared Nata De Coco Drink and the results were shown in Table 4.2

**Table 5:** Chemical composition of Nata De Coco Drink

| Chemical Composition | Sample 1 (S1) | Sample 2 (S2) | Sample 3 (S3) |
|---|---|---|---|
| °Brix (%) | 11.0 | 12.0 | 13.0 |
| Acidity (%) | 0.18 | 0.216 | 0.23 |
| pH | 2.93 | 3.51 | 3.74 |

From Table 4.2 overall analysis of developed sample shows that the best results for °Brix, Acidity & pH content are $S_3$. During study with Sugar and Citric acid $S_1$ to $S_2$ few variation are observed and from the observation, sample $S_3$ is comparatively best for tasting.

For $S_1$ and $S_2$ sample °Brix and acidity is too less is because Sugar and Citric Acid are used less. $S_1$ presented the lowest values of °Brix content

(11.0), conversely showed the highest °Brix value $S_3$ (13.0). $S_3$ has °brix content too much, because too much sugar syrup using. Table 4.2 shows that, $S_3$ results are more constant and precise comparatively than others two samples.

The acidity content of Nata De Coco Drink, which ranged from 0.18 % to 0.23%, was found to be the highest in $S_3$ (0.23%) while $S_1$ showed the lowest values (0.18%) and $S_2$, score 0.216%.

The pH value of Nata De Coco Drink, which ranged from 2.93 to 3.74, was found to be the highest in $S_3$ (3.74) while $S_1$ showed the lowest values 2.93 and $S_2$ showed 3.51.

The different proximal composition of Nata De Coco Drink commercial samples studies could be affected by many factors such as the wide range of complex ingredients added and their combinations, besides the additives used to improve the structure, mouth feels, acceptability and shelf-life of these products.

### 3.2 °Brix of Nata De Coco Drink

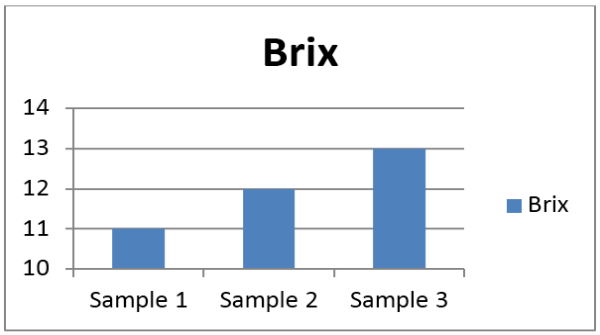


**Figure 7:** °Brix of Nata De Coco Drink

The total sugar syrup chemically preserved Nata de Coco Strawberry Drink ranged from 12.8-13.2 ºBrix respectively. The total soluble solids of samples S1, S2 and S3 were 11°Brix, 12° Brix, 13.0 °Brix shown in Figure 4.1.

### 3.3 Acidity of Nata De Coco Drink

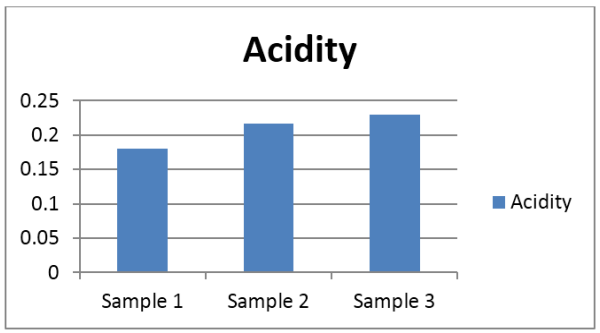


**Figure 8:** Acidity of Nata De Coco Drink

The titrable acidity of Nata de Coco Strawberry Drink ranged from 0.21-0.23% respectively. In the preparation day, the titrable acidity of samples $T_1$, $T_2$ and $T_3$ were respectively 0.18%, 0.216%,0.23% shown in Figure 4.2.

### 3.4 pH of Nata De Coco Drink

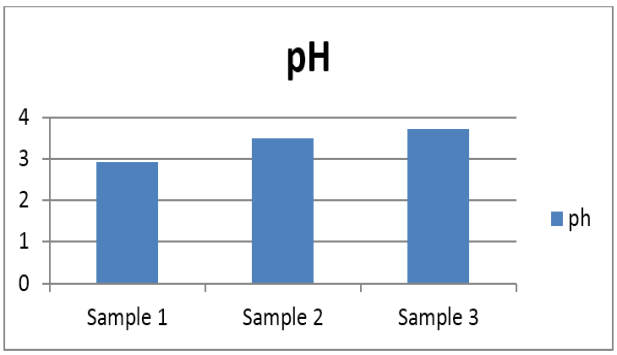


**Figure 9:** pH of Nata De Coco Drink

The pH of Nata de Coco Strawberry drinks ranged from 3.5 to 4.0 respectively. In the preparation day, the pH of samples S1, S2 and S3 were respectively 2.93, 3.51, 3.74 shown in Figure 4.3

### 3.5 Sensory evaluation

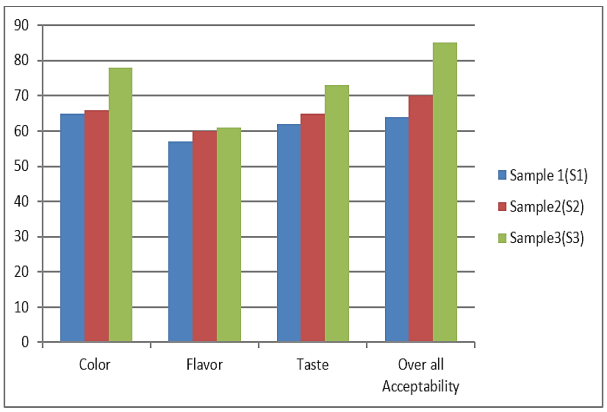


**Figure 10:** Sensory evaluation of Nata De Coco Drink

The sensorial properties were determined by trained panelists and the results of the sensory analysis of the Nata De Coco Drink samples are presented in appendix Table 4.3. The panelists scored showing their degree of preference in respect of color, flavor, taste and overall acceptability of the Nata De Coco Drink. Results highlighted that the addition of sugar and citric acid improved the sensorial quality of Nata De Coco Drink in most of the cases. In fact, the sensorial data showed that the S3 with proper sugar and citric acid had an overall quality values higher than that of other sample. Table 4.3 shows that the overall acceptability increased and stable with added proper percentage sugar and citric acid.

In fact, the score of sensorial attributes such as color, flavor, odor, taste increased with the increase of the sugar, citric acid and Nata De Coco; as a consequence the Nata De Coco Drink overall quality was also found to be a required activity of sugar & acidity. In particular, the overall quality of Nata De Coco Drink contains the amount of Sugar (13%) and Citric Acid (0.23%) appeared to be much higher in comparison with other samples, in fact; it was scored around the acceptability threshold.

Table 4.3 shows that the samples added with lower percentage of sugar and citric acid S1, S2 sensorial taste values too low score and also the S3 with higher percentage of Sugar & Citric acid (13 & 0.23%).

As per evaluation of three samples, Average value of taste of sample S3 is accepted. Because we used less citric acid in S1, more less citric acid in S3. Taste of S3 is accepted because taste quality of S1 & S2 is not perfect compared to standard. Flavor of sample 3 is better than S1 & S3.Organoleptic test of S3 is better than S1 & S2. At the end of all evaluation, S3 is accepted for manufacturing.

## 4. Conclusion

This study demonstrates that after using the citric acid and sugar the product quality are remarkably improved taste and pH and to design, construct and develop a new Nata De Coco and Nata De Coco with litchi flavor product from Nata de Coco and its comparative quality assessment.

During all Nata De Coco Drink production best quality Nata De Coco using the best results were obtained by using 71.34% water, 13% Sugar, 15% Nata De Coco, 0.03% Gellan Gum, 0.06% Sodium Citrate, 0.12% Calcium Lactate, 0.01% Ascorbic Acid, 0.03% Potassium Sorbate, 0.012% Sodium Benzoate, 0.12% Litchi Flavour, 0.23% Citric Acid Anhydrous, 0.05% Neutral Cloud. From the earlier stage of study after adding the citric acid its increases pH and taste as well, also help keep well the shelf life of the drink which were produced. From the comparative Chemical analysis results of Drinks samples using citric acid less doing and higher dosing of the same results are not constant and variation are observed from one to others (samples).

Overall analysis shows that Nata De coo Drinks which are produced with 15% Nata De Coco best results and other parameters are respectively results respectively 0.23%±0.0144 acidity; 13 ± 0.2 oBrix and pH 3.6± 0.1 in comparison with others.

As per evaluation of three samples, Average value of taste of sample $S_3$ is accepted. Because we used less citric acid in $S_1$, more less citric acid in $S_3$.

Taste of $S_3$ is accepted because taste quality of $S_1$ & $S_2$ is not perfect as per standard. Flavor of sample 03 is better than $S_1$ & $S_3$.Organoleptic test of $S_3$ is better than $S_1$ & $S_2$. At the end of all evaluation, $S_3$ is accepted for manufacturing.

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## Appendices

**Appendix 1:** °Brix of Nata De Coco Drink

| | °Brix | | | Mean |
|---|---|---|---|---|
| Sample 01 | 11.0 | 11.2 | 10.8 | 11.0 |
| Sample 02 | 12.0 | 11.9 | 12.1 | 12.0 |
| Sample 03 | 13.0 | 12.8 | 13.2 | 13.0 |

**Appendix 2:** Acidity of Nata De Coco Drink

| Sample ID | Acidity | | | Mean |
|---|---|---|---|---|
| Sample 01 | 0.19 | 0.18 | 0.17 | 0.18 |
| Sample 02 | 0.215 | 0.213 | 0.22 | 0.216 |
| Sample 03 | 0.21 | 0.24 | 0.22 | 0.23 |

**Appendix 3:** pH of Nata De Coco Drink

| Sample ID | pH | | | Mean |
|---|---|---|---|---|
| Sample 01 | 2.94 | 2.92 | 2.95 | 2.93 |
| Sample 02 | 3.52 | 3.53 | 3.48 | 3.51 |
| Sample 03 | 3.70 | 3.77 | 3.75 | 3.74 |

**Appendix 4:** Rating Score for Color of Nata De Coco Drink

| Panelist No. | Sample No. | | | Total |
|---|---|---|---|---|
| | Sample 1 | Sample 2 | Sample 3 | |
| 1 | 7 | 6 | 8 | 21 |
| 2 | 7 | 7 | 8 | 22 |
| 3 | 6 | 8 | 7 | 21 |
| 4 | 6 | 8 | 9 | 23 |
| 5 | 7 | 8 | 7 | 22 |
| 6 | 6 | 7 | 7 | 20 |
| 7 | 6 | 7 | 7 | 20 |
| 8 | 7 | 5 | 8 | 20 |
| 9 | 6 | 5 | 9 | 20 |
| 10 | 7 | 5 | 8 | 20 |
| Total | 65 | 66 | 78 | 209 |
| Mean | 6.5 | 6.6 | 7.8 | |

Hedonic scale used: 9 = Like extremely; 8 = Like very much; 7 = Like moderately; 6 = Like slightly; 5 = Neither like nor dislike; 4 = Dislike slightly; 3 = Dislike moderately; 2 = Dislike very much and 1 = Dislike extremely

**Appendix 5:** Rating Score for Flavor of Nata De Coco Drink

| Panelist No. | Sample No. | | | Total |
|---|---|---|---|---|
| | Sample 1 | Sample 2 | Sample 3 | |
| 1 | 6 | 6 | 6 | 18 |
| 2 | 5 | 5 | 6 | 16 |
| 3 | 6 | 5 | 6 | 17 |
| 4 | 7 | 7 | 7 | 21 |
| 5 | 5 | 7 | 6 | 18 |
| 6 | 6 | 5 | 6 | 17 |
| 7 | 6 | 6 | 5 | 17 |
| 8 | 5 | 7 | 7 | 19 |
| 9 | 5 | 6 | 5 | 16 |
| 10 | 6 | 6 | 7 | 19 |
| Total | 57 | 60 | 61 | 178 |
| Mean | 5.7 | 6.0 | 6.1 | |

**Appendix 6: Rating Score for Taste of Nata De Coco Drink**

| Panelist No. | Sample No. | | | Total |
|---|---|---|---|---|
| | Sample 1 | Sample 2 | Sample 3 | |
| 1 | 7 | 6 | 7 | 20 |
| 2 | 6 | 7 | 8 | 21 |
| 3 | 7 | 6 | 7 | 20 |
| 4 | 7 | 6 | 8 | 21 |
| 5 | 6 | 6 | 7 | 19 |
| 6 | 6 | 7 | 7 | 20 |
| 7 | 6 | 6 | 7 | 19 |
| 8 | 6 | 8 | 8 | 22 |
| 9 | 5 | 6 | 7 | 18 |
| 10 | 6 | 7 | 7 | 20 |
| Total | 62 | 65 | 73 | 200 |
| Mean | 6.2 | 6.5 | 7.3 | |

**Appendix 7:** Rating Score for overall acceptability of Nata De Coco Drink

| Panelist No. | Sample No. | | | Total |
|---|---|---|---|---|
| | Sample 1 | Sample 2 | Sample 3 | |
| 1 | 6 | 7 | 9 | 22 |
| 2 | 7 | 6 | 9 | 22 |
| 3 | 6 | 7 | 8 | 21 |
| 4 | 6 | 8 | 9 | 23 |
| 5 | 7 | 6 | 8 | 21 |
| 6 | 7 | 8 | 8 | 23 |
| 7 | 6 | 6 | 9 | 21 |
| 8 | 6 | 7 | 8 | 21 |
| 9 | 7 | 8 | 9 | 23 |
| 10 | 6 | 7 | 8 | 21 |
| Total | 64 | 70 | 85 | 219 |
| Mean | 6.4 | 7.0 | 8.5 | |