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IDENTIFICATION OF THE CAUSES NATA DE COCO PRODUCTION DEFECTS FOR QUALITY CONTROL

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ARTICLE INFO

ABSTRACT

Nata de coco is food made from coconut water waste which can be consumed and can help improve the digestive process. The results of fermentation at PT XYZ still contain damaged or moldy nata sheets. The purpose of this study is to identify the causes of nata sheet defects. The identification of production defects in this study uses a fishbone diagram. The results of this study show that the cause of nata de coco sheet defects is the quality of coconut water that is too old (contains oil), too young (does not contain minerals), too long exposure to open air (contaminated with other bacteria). So that the resulting starter seeds are not good enough. Other causes are because the tray used is not clean (still runny), the newspaper used is torn (wide open), shocks occur during fermentation, alkaline pH, fluctuating air temperature, the boiling process has not reached boiling point, and the amount of additional materials (ZA fertilizer and sugar) is not quite right.

INTRODUCTION

The use of coconut water waste that produces results in the form of nata de coco products presents a profitable business for business actors. However, the nata de coco production process still has problems that must be found for alternative solutions so that the resulting quality is better and the profit in the nata de coco business can be maximized. As happened in the fermentation process of making nata de coco, there are still defective nata sheets that are not as expected. Where, disability is something that is not desired by consumers and reduces satisfaction (Basuki, 2019). Satisfaction is that consumer wants and needs can be fulfilled, and does not present complaints (Mujiraharjo & Basuki, 2019). If consumers reject a product, production inhibition, production capacity is not on target, and even a complete cessation of production can occur (Basuki, 2017). Therefore, to minimize the defective products of nata de coco, this study seeks to identify the causes of defects in the nata de coco fermentation process.

If the cause of nata de coco defect is identified, it can certainly support the quality control of nata de coco.

The process of identifying problems has been carried out by Bilianto and Ekawati using fishbone diagrams to find the causes for the underperformance of the printing machine (Bilianto & Ekawati, 2017). Slameto uses a fishbone diagram to improve school quality (Slameto, 2016). Rimantho and Mariani used a fishbone diagram to determine the largest percentage of defects in water quality control (Rimantho & Mariani, 2017). Using a fishbone diagram, Casban analyzes the causes of work accidents in the washing container process in the cleaning division (Casban, 2018). Likewise, Gumilar and Siregar used a fishbone diagram to determine the most dominant type of damage to the sediment motorizer machine at PDAM Tirta Pakuan, Bogor City (Gumilar & Siregar, 2017).

The quality of nata de coco can also be increased with the addition of 50% super red dragon fruit juice which can produce a yield of 86.3%, a thickness of 1.5 cm, and is widely liked by panelists in terms of aroma, color, taste, and texture (Lubis & Harahap, 2018). *The quality of nata can also be affected due to the regulation of sugar dosage, pH, and fermentation time. The maximum conditions in the formation of nata de corn are 9 grams of sugar, a pH of 5, and a fermentation time of 14 days* (Rizal, Pandiangan, & Saleh, 2013).

From previous research that discusses the fishbone diagram method and about nata, there is still no research that discusses the causes of nata defects as a whole in order to improve the quality of nata. So, this research discusses the things that cause nata disability using a fishbone diagram. By knowing the causes of nata defects, it is hoped that the quality of nata produced in Indonesia in particular will be continuously better.

RESEARCH METHOD

Coconut trees in Indonesia have a fairly large area of land, recorded in 2017, the area of smallholder coconut plantations was 3,617,000 hectares (BPS, 2018). The coconut tree or in Indonesian it can also be called the *Nyiur* tree, is a very important plant, because this plant is very useful for humans in everyday life, and is one of the export commodities. All parts of this plant, can be used. Starting from the tips of leaves, fruits, tree trunks, and to the roots, all of them can be used in life. For example, the leaves become the roof until the leaves become a diamond wrap and so on. In fact, coconut water which is considered waste from coconuts can still be used.

The most important part of the coconut plant is coconut fruit, because it has high economic and nutritional value (Rindengan, 2004). To get good physical quality coconut fruit, coconut cultivation is better in peatlands because there are many nutrients on peat so that coconut plants have the opportunity to get more nutrients than if cultivated in tidal lands (Hartawan, Nasamsir, & Gaful, 2017). Where the coconut fruit consists of four components, namely coir, shell, fruit flesh, and coconut water. In Indonesia, it is often found like a broom, a mat made of coconut husk. Other examples include charcoal, a container for rubber tree sap made from coconut shells. The coconut fruit can be used as cooking oil, coconut milk and copra. Young coconuts and coconut water are also often consumed as ice dogan. In addition, coconut water is also used as a raw material for making nata de coco.

Nata is a healthy food to consume because it contains fiber (Hamad, Hidayah, Solekhah, & Septhea, 2017). Nata can be used to improve the digestive process. Some of the raw materials that can be used for nata are coconut water, tofu liquid waste, jicama starch waste, tapioca waste, fruit juice (melons, pineapples, bananas, strawberries, guava, oranges) (Wardhana, Rusmarilin, & Yusraini, 2016). The best nata formation can be done at levels $(NH_4)_2SO_4$ 0.4% because the development of the *Acetobacter xylinum* bacteria requires a nitrogen source where the addition of $(NH_4)_2SO_4$ to 0.4% is still positive and shows no symptoms of inhibiting bacterial development (Yunianta, 2010).

This research was conducted at PT XYZ which produces nata de coco sheets. For quality improvement, this study focuses on identifying the causes of defects that still exist in PT XYZ

during the fermentation process. The process of identifying the causes of disability using the fishbone diagram method.

Data collection methods used in this study are literature studies, field surveys, and interviews with experts. Literature studies are carried out in order to broaden researchers insights so that research can be scientifically justified, literature studies are conducted before conducting field surveys. The field survey was conducted by visiting PT XYZ and observing all ongoing processes, namely the boiling process of coconut water, the pouring process on the tray, the seeding process, the fermentation process, the harvesting period, the stripping process, the cutting process, the sorting process, the pressing process, the packaging process. Interviews with experts, conducted with the coordinator of the fermentation section, thoroughly interview topics, both regarding the production process, types of defects, as well as the things that cause the nata sheets to have defects.

PT XYZ is a company engaged in the agro-industrial production unit which produces nata de coco products. There are specifications nata qualified or nata who otherwise qualified are:
1. Nata size ± 25 x 35 cm,
2. ± 1 cm thickness of nata,
3. Flat top and bottom sheets of nata, without holes,
4. Not moldy

From the nata specifications that meet these requirements, fungal growth gives a greater level of defect than others or gives a greater level of loss compared to others. So, this research used disability is a disability due to fungal growth on nata de coco.

The nata de coco produced has different qualities, the difference can be seen from the perfect and imperfect fermentation process. The completion of the fermentation process is a success that states that the nata de coco product is good and of high quality. The good and quality character of nata de coco can be seen from the presence or absence of fungi that grow in nata de coco products. If nata de coco is not moldy, it can be stated that the product is good and qualified, or can also be said, getting a little fungus that grows on nata de coco, then the product nata de coco is declared the better the quality. On the other hand, the more fungi that grow on nata de coco, the nata de coco is declared a product of low quality or even a defective and failed product. The whole production process of nata de coco sheets can be seen in figure 1. Figure 2 describe the details of the nata de coco fermentation process at PT XYZ.
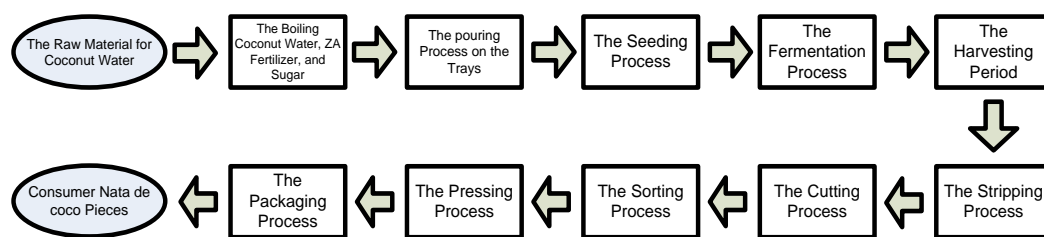

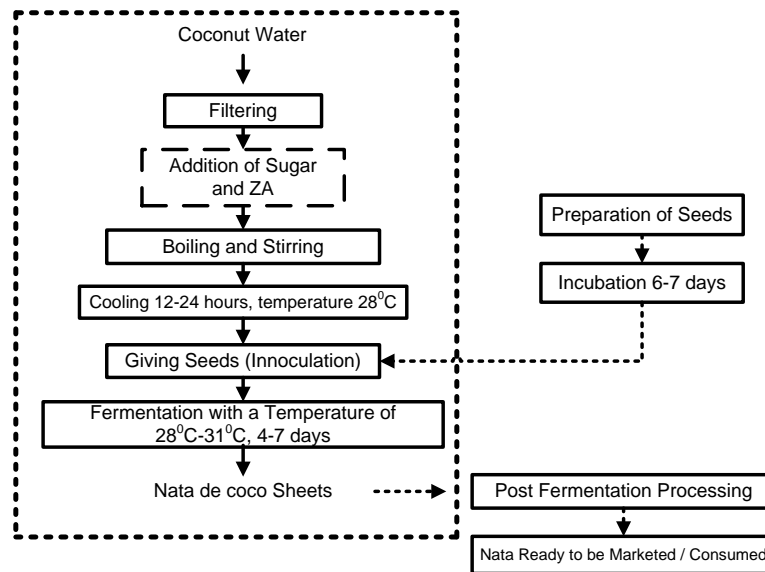Figure 1. Flowchart of the PT XYZ production process

Figure 2. Flowchart of the fermentation process for nata de coco

In the production process of PT XYZ, to be precise in the fermentation process, there are fermentation products of nata de coco with different qualities. This difference can be seen from the perfect and imperfect fermentation process. The imperfect fermentation process, among others, can affect the elasticity of the nata de coco. In this case, the fermented products of nata de coco fall into two categories, namely first quality and second quality. For the first quality is nata de coco which does not have any fungus to grow, and the second quality is nata de coco which is overgrown with mushrooms.

Figure 3. Types of defects in *nata de coco* sheets (second quality)

Figure 4. Good *nata de coco* sheets (first quality)

With the second quality, this can create consumer dissatisfaction with the fermented nata de coco because customer satisfaction is not fulfilled. This, consumer dissatisfaction or consumer mismatch with the product, will cause harm to the company and greatly affect the image or reputation of the company due to the imperfect fermentation quality of nata de coco This research is here to identify the factors that cause the nata de coco sheet to grow fungus in order to improve the quality of the nata.

RESULTS AND DISCUSSION

In order to improve the quality of nata sheet, this study identifying the factors that cause fungal growth in nata, which on this occasion using a fishbone diagram or cause-effect diagram or Ishikawa diagram. Figure 5 are the production conditions for nata de coco at PT XYZ.
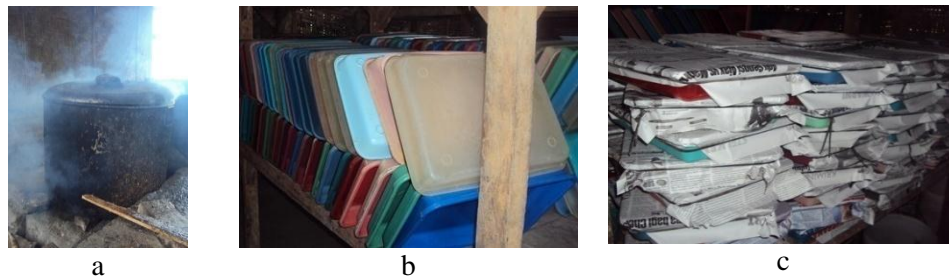
Figure 5. Boiling coconut water and its additives (a) 100 liter pan, (b) trays for fermentation, (c) fermentation process

Based on data from the company and the results of interviews with the coordinator of the fermentation section, the factors that can affect the growth of fungi in nata de coco products can be seen in the figure 6.
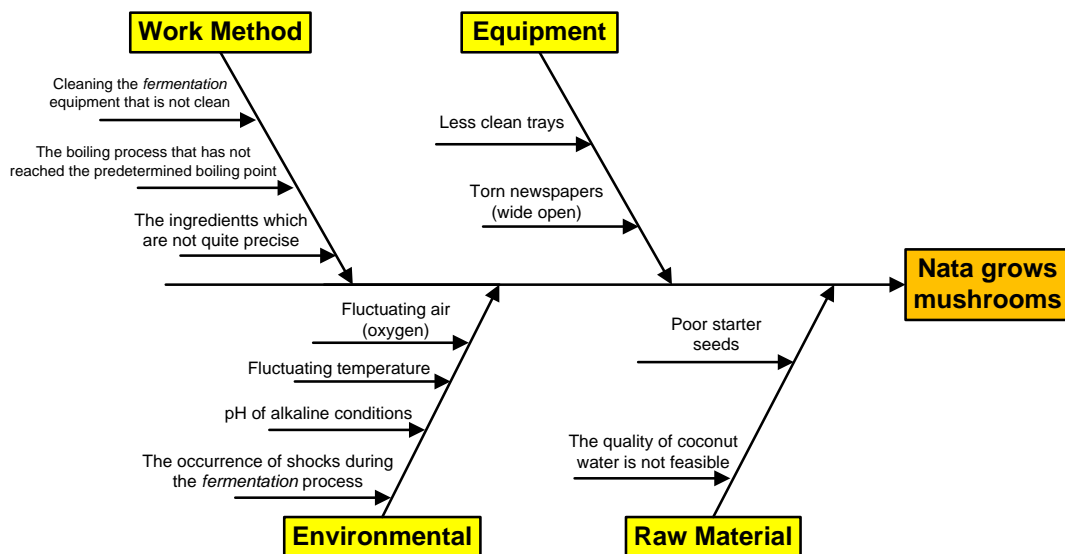

Figure 6. Fishbone diagram of growing mushrooms on nata de coco

From the fishbone diagram above, it can be explained as follows:

A. The raw material factors include the quality of coconut water which is no longer suitable for use and poor starter seeds.
  1. Good coconut water is obtained from optimal old coconut, not too old and not too young. Too old coconut water contains oils that can inhibit the growth of seedlings *nata Acetobacter xylinum* for seeds *nata* dislike excessive oil. Likewise, coconut water that is still young does not contain enough minerals in it, so it is not good for use. Unsuitable coconut water also results from prolonged exposure to open air, so that coconut water can be contaminated by other bacteria.
  2. Seed starters were not good due to the coconut water is less qualifies as previously described.

B. The equipment factors used include less clean trays and torn newspapers (wide open).
  1. The lack of cleanness of the trays used is like there is still water left in the trays because the drying process is not perfect.
  2. Another cause is the torn newspaper (wide open) when it is being used to cover the tray filled with *nata de coco*, so that by tearing the cover newspaper, the *nata de coco* becomes contaminated with free air and will greatly determine the quality of the *nata de coco* results later.

C. Environmental factors include the occurrence of shocks during the *fermentation* process, the acidity (pH) of alkaline conditions, fluctuating temperature conditions, and fluctuating air (oxygen).
1. The shock that occurs in the *fermentation* process will result in *nata de coco* with multiple layers.
2. The acidity level of pH 4.3 is very suitable for the growth of *Acetobacter xylinum* bacteria or can grow in a pH range of 3.5 - 7.5, if the environment is alkaline, the *Acetobacter xylinum* bacteria will experience interference with their cell metabolism.
3. The ideal temperature for the growth of *Acetobacter xylinum* bacteria is 28˚C - 31˚C, if it is below 28˚C the seeds will be damaged and even at a temperature of ± 40˚C the *Acetobacter xylinum* bacteria will die.
4. The fluctuating air (oxygen) condition while being carried out by the *fermentation* process will disrupt the growth of *nata de coco,* because *nata* bacteria are very susceptible to contamination conditions and the influence of environmental conditions.

D. The work method factors include cleaning the *fermentation* equipment that is not clean, the boiling process that has not reached the predetermined boiling point, and the process of giving the additional ingredients which are not quite precise.
1. Tools related to the cause of *nata de coco* failure, such as trays that still have water spots due to poor drying or drying, dirty and watery wet newspaper which also needs to be dried or dried before use, and bottles for the manufacture of starter seeds that still contain water so that the starter seeds with poor results.
2. Coconut water is the boiling point of more than 100˚C which is usually marked by the waters began lumpy. If for 100 liters of coconut water, the process is lumpy, which takes 45 minutes - 60 minutes or even more.
3. Another factor is the inaccurate process of adding additives, such as ZA *(ammonium sulfate)* fertilizer, and sugar.

By identifying the factors that cause nata production defects in the above discussion, producers can control the quality of nata from the beginning and it is hoped that nata producers in Indonesia especially will be more careful in producing nata, so that, they can produce better quality nata sheets.

CONCLUSIONS

From the above discussion, it is known that the causes of nata de coco product defects in the nata sheet production process are due to the quality of coconut water that is too old (contains oil), too young (does not contain minerals), too long exposure to open air (contaminated with other bacteria). So that the resulting starter seeds are not good enough. Other causes are because the tray used is not clean (still runny), the newspaper used is torn (wide open), shocks occur during fermentation, alkaline pH, fluctuating air temperature, the boiling process has not reached boiling point, and the amount of additional materials (ZA fertilizer and sugar) is not quite right.

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