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Analysis of Quality Control of Honey Sachet Product Using Statistical Quality Control (SQC) Method on CV Madu Apiari Mutiara

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ABSTRACT

CV Madu Apiari Mutiara is a company that produces various types of honey products. One of the products is sachet honey products. In the process, there are still many defects that occur. There are 5 types of defects that occur in the product, including: empty, short packaging, long packaging, underfilled, and overfilled. From the observations, it was found that of the 1750 products, there were 162 products that were defective (9.26%). The calculation results also show that the defects that occur are still outside the control limits. The aim of this study is to analyze quality control in sachet honey products using the statistical quality control (SQC) method. Quality control analysis is carried out using several quality control tools, including check sheets, control charts, Pareto diagrams, fishbone diagrams, and 5W1H analysis. The research results show that there are three factors that influence the production process: human, machine, and environmental factors.

Keywords: SQC, Honey, Quality

1. Introduction

In today's instantaneous era, consumer needs are becoming increasingly varied every day. The ease with which a product can be carried when traveling is one of the factors that consumers pay attention to when purchasing a product. It is important for companies to continue to innovate their products in order to survive in the face of competition with other products, as well as increase consumer buying interest [1].

In the industrial sector, packaging is one of the most important factors. Almost all products on the market are sold in packaging [2]. The choice of packaging must go through several considerations, such as health, communication and aesthetics so that the product looks attractive and can attract consumer interest [3]. Apart from that, it is important for companies to choose the right

material as the basic material for packaging. This is because packaging has an important role in protecting the packaged product [4]. If the packaging is made of good material, the product can be protected and the product's lifespan can be maintained.

CV Madu Apiari Mutiara as one of the leading honey companies continues to strive to provide the best service to meet consumer needs. One of the efforts made is to produce honey in sachet packaging. Honey sachets are produced in small plastic with a net weight of 20 grams. However, in practice, production activities did not run according to expectations. There are still defects that occur during the production process.

Table 1: Product Defects

Types of Defects	Total Production	Total Defect
Empty	350	25
Long Packaging	350	35
Short Packaging	350	37
Underfilled	350	32
Overfilled	350	33
Total	**1750**	**162**

This defect occurs both in the packaging and in the contents. In the contents section, there are products that have a net weight of less than 20 grams. Some products also weigh more than 20 grams, and some products are even empty with no contents. Then, in the packaging section, some products have sachet sizes that are less than the standard, and there are also products that have sizes that exceed the specified standards. As a result of this defect, the company needs to increase its production volume from what was previously planned to make 300 pieces, so production must be increased to 350 pieces. As a result, there is a buildup of products in the warehouse and employees need to take out the honey contained in these defective products one by one.

Therefore, further analysis is needed so that the proportion of defects can be minimized. The method used in this study is the Statistical Quality Control (SQC) method. Through this method, the author will be able to find out what factors cause defects so that he can provide suggestions for improvement to the company.

2. Material and Methods

Statistical Quality Control (SQC) is a quality control method that identifies, controls and analyzes problems that occur using a statistical approach. According to Heizer and Render, the SQC method is a process used to monitor, measure and take corrective action when goods or services are produced [5]. The following are the quality control tools used in this study:

2.1 Check Sheet

Check sheets are used to assist in collecting and recording the number of products produced and the amount of damage that occurs to the product [6]. Through check sheets, all types of defects that occur will be grouped so that it will help the author read and understand the defects that occur in the product

2.2 Control Chart

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A control chart is a graph used to see whether the damage that occurs to a product is outside the control limits or is still within the control limits [6]. If the calculation results show that the damage that occurs to the product is beyond control limits, then this indicates that repairs must be carried out immediately.

There are various types of control charts, ranging from p-charts, np-charts, c-charts, etc. In this study, the type of control chart used is the np-chart control chart. This type of control chart was chosen because the np-chart is used if the number of products observed is constant or the same every time an observation is made. Below are the steps in calculating the np-chart control:

1) Calculate the proportion of defects for each group ($\hat{P}$)
$$P_i = \frac{np}{n} \quad \text{.....(2.1)}$$

2) Calculate the average defect
$$\overline{P} = \frac{Total\ Defect}{Total\ Production} \quad \text{.....(2.2)}$$

3) Calculate the Upper Control Limit (UCL) and Lower Control Limit (LCL)
$$UCL = \overline{P} + 3\sqrt{\frac{\overline{P}(1-\overline{P})}{n}} \quad \text{.....(2.3)}$$
$$LCL = \overline{P} - 3\sqrt{\frac{\overline{P}(1-\overline{P})}{n}} \quad \text{.....(2.4)}$$

2.3 Pareto Diagram

According to Kaban the Pareto diagram can identify what types of damage occur most frequently so that you can know what types of damage are priorities to be resolved first [5]. Through the Pareto diagram, you will know the type of damage, from the largest to the smallest.

2.4 Fishbone Diagram

The fishbone diagram is used to show the factors that influence product damage [5]. There are five factors contained in the fishbone diagram, including man, machine, method, material, and environment factors.

2.5 5W-1H

5W-1H analysis is a brainstorming method that can be used to solve problems. Basically, the 5W1H analysis follows the saying that says, "If you have written down your problem, then you have solved half of the problem."

This analysis can be used to identify defects that occur in products by asking six questions, and it is hoped that through this analysis it can provide suggestions for improvements to the company.

5W1H analysis is used to describe and analyze problems by answering 5 questions starting with the letter "W," namely What, Where, When, Who, and Which, and 1 question starting with the letter "H", namely How [7].

3. Result and Discussions

3.1 Check Sheet

Checksheet is a tool used to describe data as well as classify it. There are five types of sachet honey products produced by CV Madu Apiari Mutiara. Each product has many different defective parts. The check sheet below contains the types of defects that occur in sachet honey products produced by CV Madu Apiari Mutiara:

Table 2: Check sheet

Products	Total Production	Types of Defect					Total	% Defect
		Empty	Long Packaging	Short Packaging	Underfilled	Overfilled		
Madu Kelengkeng	350	8	11	12	14	11	56	34.57%
Madu Propolis	350	4	8	7	5	8	32	19.75%
Madu Kapuk Randu	350	3	6	6	4	4	23	14.20%
Madu Honey Kids	350	3	4	5	3	4	19	11.73%
Madu Organik	350	7	6	7	6	6	32	19.75%
		25	**35**	**37**	**32**	**33**		
Total	**1750**	**15.43%**	**21.60%**	**22.84%**	**19.75%**	**20.37%**	**162**	**100%**
		% Defect						

3.2 Control Chart

The honey sachet product defect data that has been obtained is then calculated using the np-chart control chart. This calculation was carried out because the number of defects that occurred in each type of sachet honey product was different. Through this calculation, it will be known whether the proportion of defects that occur is still within control limits or not.

The following are the steps for calculating np-chart control charts:

3.2.1 Calculate the proportion of defects

$$P_i = \frac{np}{n} \quad \text{.....(2.1)}$$

$$P_i = \frac{56}{350}$$

$$P_i = 0{,}160$$

Table 3: Defective Proportions

No	Products	Total Production	Total Defect	Defective Proportion (Pi)
1	Madu Kelengkeng Sachet	350	56	0.160
2	Madu Propolis Sachet	350	32	0.091
3	Madu Kapuk Randu Sachet	350	23	0.066
4	Madu Honey Kids Sachet	350	19	0.054
5	Madu Organik Sachet	350	32	0.091
	Total	**1750**	**162**	**0.463**

3.2.2 Calculate the Average Defect

$$\overline{P} = \frac{Total\ Defect}{Total\ Production} \quad \text{.....(2.2)}$$

$$\overline{P} = \frac{162}{1750}$$

$$\overline{P} = 0{,}0925$$

3.2.3 Calculate the Upper Control Limit

$$UCL = \overline{P} + 3\sqrt{\frac{\overline{P}(1-\overline{P})}{n}} \quad \text{.....(2.3)}$$

$$UCL = 0{,}0925 + 3\sqrt{\frac{0{,}0925(1-0{,}0925)}{350}}$$

$$UCL = 0{,}1390$$

3.2.4 Calculate the Lower Control Limit

$$LCL = \overline{P} - 3\sqrt{\frac{\overline{P}(1-\overline{P})}{n}} \quad \text{.....(2.4)}$$

$$LCL = 0{,}0925 - 3\sqrt{\frac{0{,}0925(1-0{,}0925)}{350}}$$

$$LCL = 0{,}0461$$

Table 4: Value of UCL and LCL

No	Products	UCL	Pi	LCL
1	Madu Kelengkeng Sachet	0.1390	0.1600	0.0461
2	Madu Propolis Sachet	0.1390	0.0914	0.0461
3	Madu Kapuk Randu Sachet	0.1390	0.0657	0.0461
4	Madu Honey Kids Sachet	0.1390	0.0543	0.0461
5	Madu Organik Sachet	0.1390	0.0914	0.0461

3.2.5 Create Control Chart (np-Chart)

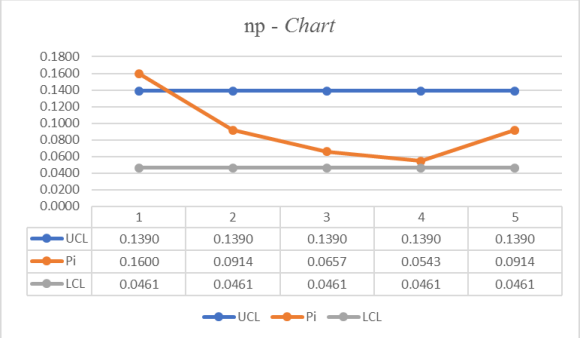

Figure 1: Control Chart

The results of the np-chart control chart calculation show that the proportion of defects occurring in sachet honey products is still beyond the control limits. This can be seen in the level of defects that occur in type 1 products, where the proportion of defects (pi) still exceeds the UCL limit. Therefore, control must be carried out through the process of identifying what types of defects cause the proportion of product defects to be outside the control limits using a Pareto diagram.

3.3 Pareto Diagram

The Pareto diagram is used to describe the types of defects that most often occur in sachet honey products produced by CV Madu Apiari Mutiara. There are 5 types of defects that occur, namely: empty, long packaging, short packaging, underfilled, and overfilled. The following are examples of each type of defect.

Table 5: Types of Defect

No	Types of Defect	Defect
1	Empty	
2	Long Packaging	
3	Short Packaging	

4	Underfilled	
5	Overfilled	

The following is a Pareto diagram of each type of defect that occurs in sachet honey products:

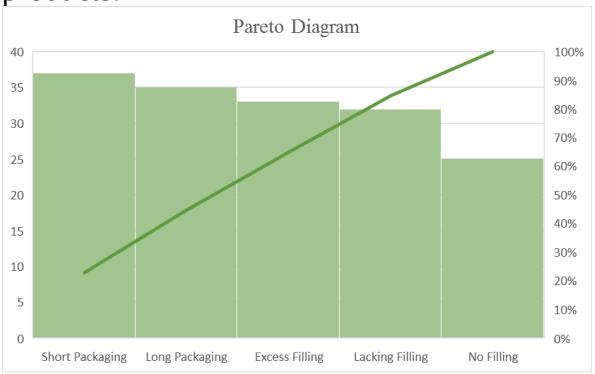

Figure 2: Pareto Diagram

The Pareto diagram above shows that the type of short packaging defect is the type of defect that occurs most frequently, with an incidence percentage of 22.84%. Then followed by the long packaging at 21.60%, overfilled at 20.37%, underfilled at 19.75%, and empty at 15.43%.

3.4 Fishbone Diagram

After knowing what types of defects most often occur in sachet honey products, a fishbone diagram is then made to find out the factors that cause these defects to occur, with short sachet defect types as the main focus.

To create this diagram, brainstorming is required with the operator who produces the product. Brainstorming activities are carried out on the basis of information obtained through interviews with operators. The following is a table of interviews with the operator.

Table 6: Interview with The Operator

Author	Operator
The room is hot, right?	Yes, it's really hot. Especially if there's a crowd. There's only 2 people here at most. If it's more than that, it will be really hot.
What's the approximate size of this room?	It's small. At most only 3 x 2.5 m.
What's the height, 2 meters?	Maybe 2 - 2.5 meters.
It turns out that to control the filling is still manual, right?	Yes, it's still manual.
How much did it cost to buy the machine?	No, it's free. Other companies give it.
When the machine was first provided, was there training to operate the machine?	There wasn't. There was no training or manual.

The results of the interview will then be used as the basis for creating a fishbone diagram. Below is a fishbone diagram to identify factors that cause defects:

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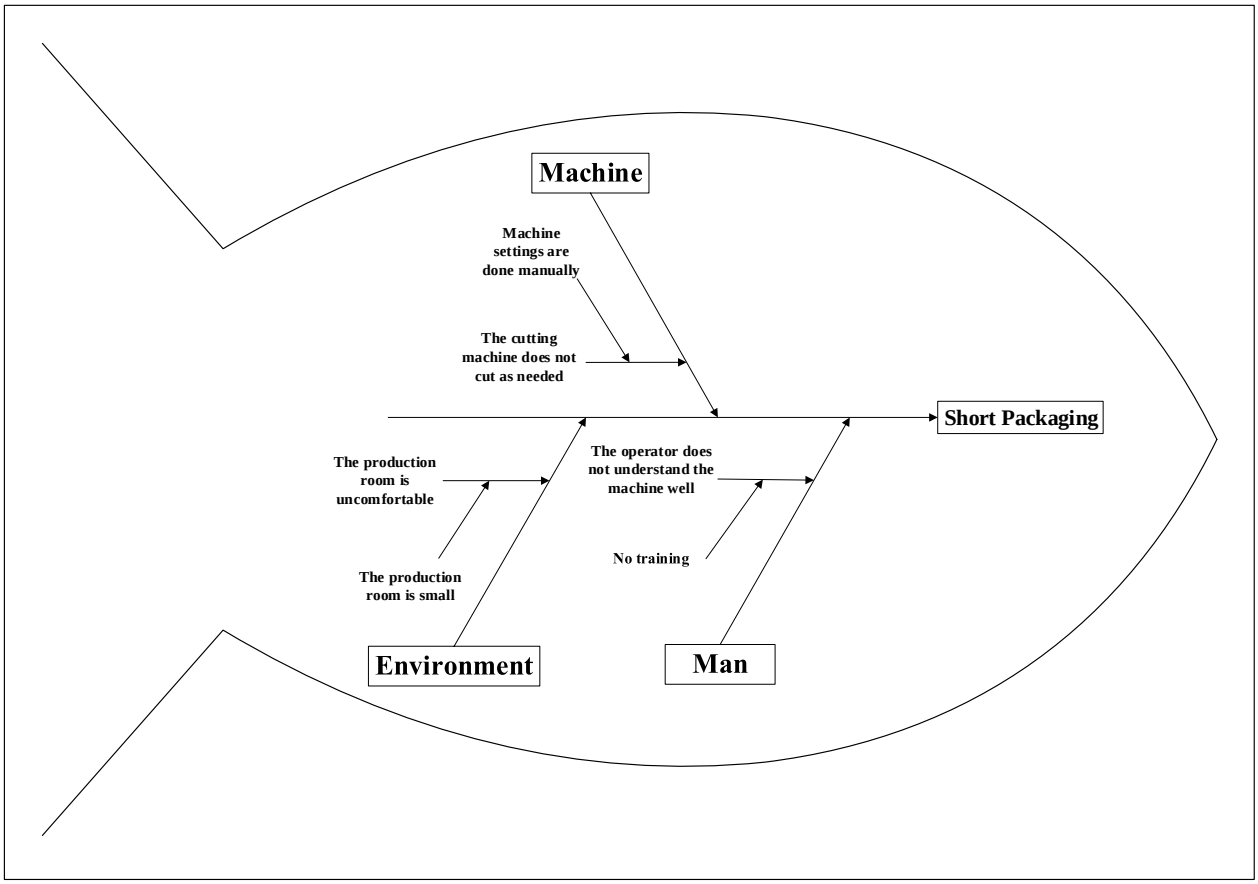

Figure 3: Fishbone Diagram

There are three factors that cause short packaging in the sachet honey products, namely: human, machine and environmental factors. The following is an explanation of each factor contained in the fishbone diagram:

a. Human

The operator's understanding of production machines has a big role in the final product results. If the operator understands how to operate the machine well, the final product results will also be more guaranteed. The machine operators at CV Madu Apiari Mutiara still do not understand how to operate the machine properly because previously there was no special training regarding operating the machine. So far, operators have only operated the machine using feeling.

b. Machine

The machine owned by CV Madu Apiari Mutiara is still very simple. Therefore, the setup process is still done manually. As a result, many defects still occur every time it is produced.

x 2.5 x 2.5 meters. The production room is always hot, so it is very uncomfortable.

c. Environment

The comfort of the production environment influences operator performance. The honey sachet production room at CV Madu Apiari Mutiara is considered uncomfortable. This is because the honey sachet production space is very small, only 3

3.5 5W1H Analysis

5W1H analysis is carried out to identify factors that cause problems by answering questions and providing suggestions for improvements that are expected to reduce the occurrence of damage to the product.

Table 7: 5W1H Analysis

Factors	What	Why	Where	When	Who	How
Man	The operator does not understand how to operate the machine well	No training for operationg the machine	The honey sachet production room	Every production process	Production operator	Conduct training on machine operation
Machine	The cutting machine does not cut as needed	The maching set up done manually	The honey sachet production room	Every production process	Production operator	Create an SOP for machine settings
Environment	The production room is uncomfortable	The production room is small	The honey sachet production room	Every production process	Production operator	Expand the production room

Through the 5W1H analysis, recommendations for improvement of each factor that causes defects are obtained. For human factors, it is recommended to provide training to operators regarding the operation of production machines. This needs to be done because the operator is the first person directly related to production. If the operator has reliable capabilities, production results will be more guaranteed.

The need for an SOP regarding production machine settings is a suggestion that CV Madu Apiari Mutiara must be carried out to overcome machine factors. By establishing this SOP, it is hoped that operators will operate the machine in accordance with existing standards, not just using their feelings.

And for environmental factors, suggestions for improvements that must be made are to expand production space. By expanding the production space, it is hoped that the space will become more comfortable so that operators can carry out the production process in prime condition.

4. Conclusion

From the study that has been conducted, it can be concluded that there are five types of defects that occur in sachet honey products, including: empty, short packaging, long packaging, underfilled, and overfilled. And the results of control chart (np-chart) calculations show that the first type of

product, madu kelengkeng sachet, is outside the control limits. Therefore, repairs need to be carried out immediately to minimize the occurrence of product defects

Pareto diagram calculation shows that the type of defect that occurs most frequently is short packaging. Then we find the cause of the problem using fishbone diagram with short packaging as the main focus. Through the fishbone diagram, which was created based on brainstorming carried out together with the machine operator, it was found that there are three factors that cause defects, including: human, machine and environmental factors.

Suggestions for improvements that should be made by CV Madu Apiari Mutiara to minimize the occurrence of defects are holding machine operation training activities, creating SOP for machine settings, and expanding production space.

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