QUALITY CONTROL OF RAW MATERIALS FOR CANDIED CARICA USING P-CHART ANALYSIS AND FISHBONE DIAGRAM

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Abstract: Carica is a plant that can only grow in the Dieng area of Wonosobo. This causes raw materials only to be obtained in the Wonosobo area. The number of Carica processing efforts, causing entrepreneurs must be able to optimize the quality of raw materials. One of the companies that process Carica is a CV. Yuasa Food Berkah Makmur, to find out companies in asking for quality raw materials. The purpose of this study is quality control to minimize defective products produced by the company. Without the process of controlling product quality, the company will correct losses. This study was conducted to determine the quality of raw materials used in the process of making Carica candied fruit based on SQC analysis. The sample is the result of a 100% examination. The method of data analysis uses p (p-chart) control maps and causal diagrams. The results of the analysis of data testing in January to June 2018, there are two months raw material for Carica candied fruit, which is outside the boundaries of the March and April statistical data. In March there is one result of the quality of raw materials above. In April, there is one result of the quality of raw materials above the access limit. Analysis of analysis using Fishbone Diagrams found the priority due to uncontrolled quality of raw materials, human factors, raw material factors, and environmental factors.

Keywords: Quality Control, P-chart, Cause-Effect Diagram, Candied Carica.


The industrial sector that is developing very much found in Indonesia, especially those engaged in processing agricultural products. One of the industries that process agricultural products is a CV. Yuasa Food Berkah Makmur in Wonosobo Regency, which is a company that processes Carica fruit by making it sweets as a superior product.

To market products broadly and increase business scale, companies must be able to meet customer satisfaction. One of the company’s efforts to meet customer satisfaction is to maintain the quality of the products produced. The problem that is often faced by companies during the production process is the existence of a product that fails or re-
Quality control is a basic factor in consumer decisions in consuming products and services. This is widespread, without distinguishing whether consumers are individuals, industry groups, military resilience programs, and even retail stores. Quality control plays an important role to determine the extent to which the processes and results of products (services) are made following the standards set by the company. In addition to this, quality control is part of the final product that has specifications following with predetermined quality standards so that product design costs, inspection costs, and production process costs can run efficiently (Haryono, 2015).

Quality control is an activity carried out to ensure that the process that occurs will produce products following the objectives set by the company. Quality control activities are evaluating and comparing process performance with set goals. This includes all activities in the framework of routine supervision, starting from raw materials, production processes to final products (Puspitasari, 2004).

Statistical quality control means controlling by statistical methods starting from raw materials, during the production process until the final product and then adjusted to the standards set so that it can produce quality and non-defective products (Yuliasih, 2014).

Statistics have been carried out by several previous researchers. Faisal et al. (2016), that the results of the analysis of the (np-chart) control showed that there were several types of disabilities during the bread production process in Mahabah’s industrial houses, among others are pillow (74%), undercooked (15%), leaked contents (7%) and burnt (7%). The most dominant cause of disability of the product is the basic ingredients of bread making, namely the quality of flour is not good.

Elmas (2017) empirical research, states that controlling quality at Bakery Bakery is good because the number of products is still within reasonable limits, which is located between the boundary (UCL) and the lower limit (LCL). Analysis of cause and effect diagrams shows that the main factor causing product failure is due to human negligence or human resource factors.

According to Assauri (2011), the main purpose of controlling quality is to get a guarantee of the quality of products or services produced following with the quality standards that have been made by issuing costs incurred or as low as possible. Quality control cannot be separated from production supervision because quality control is part of production control.

The quality of the goods produced is determined by the activities carried out at the beginning of the production process until the finished goods. So that the resulting product is of good quality, when approved as well as possible the production activities carried out by the company are still found products that are damaged or deviate from the standards set by the company (Bakhtiar et al. 2013).

There are four types of product quality control, including quality control of raw materials. The raw materials used must be following with the quality specified by the company, this needs to be considered since the planned purchase of raw materials, receipt of raw materials in the warehouse, storage of raw materials in the warehouse, up to when the raw materials will be used. The quality of raw materials will be very decisive in the final product made. The best quality raw materials will produce a good product, and vice versa if the quality of raw materials used is bad, then it will produce a product that is not qualified (Prawirosentono, 2004).

Based on the above explanation, it is necessary to research on the quality standards of Carica fruit candied raw materials in the CV. Yuasa Food Berkah Makmur. This study discusses to determine the quality of raw materials in the process of making Carica candied fruit following with statistical limits or not based on SQC analysis.

METHOD

This research was conducted at CV. Yuasa Food Berkah Makmur, one of the companies that process Carica fruit into sweets. The research design used in this study is quantitative which forms
Miftah Aini Panjaitan, Any Suryantini, Jamhari

descriptive, namely by explaining and describing the implementation of supervision of Carica’s raw materials, and any dominant factors that cause improvement in the quality of Carica’s raw materials. Data processing is carried out for six months, from January to June 2018.

The source of the data in this study is primary, which is obtained from daily observations and interviews with related parties, the head of the field of acceptance of Carica fruit raw materials and peel partners. Carica raw materials consist of data on Carica’s raw material damage.

The number of samples used in the control chart analysis is 100% inspection of the total number of raw materials from January to June 2018. The number of samples of raw materials from January to June 2018 is 55.525 kg of Carica fruit. Observations are made during March-April 2019.

Data analysis techniques were carried out using statistical quality control consisting of control diagrams and carried out using mini tab version 18 software. Data analysis was carried out for monitoring the Carica raw material as follows:

- **P Chart**
  Control chart, or map control is one of the many tools to control product quality (Ariani, 2004). But if the sample is taken for each observation, then it can use a map controlling the proportion of errors (p-chart). Maps obtained by looking for contradictions between the number of damaged products and the total number of products in the same amount (Haryono, 2015). The following steps in making the approval map are as follows:
  a. Calculate damage presentation

  \[ P = \frac{x}{n} \]

  \( P = \) proportion of errors in each sample
  \( x = \) wrong number of products in each sample
  \( n = \) the number of samples taken during an inspection
  b. Calculating the centerline of the map controlling the proportion of errors is:

  \[ GP = \bar{P} = \frac{\sum_{i=1}^{g} P^i}{g} = \frac{\sum_{i=1}^{g} x^i}{n \cdot g} \]

  \( \bar{P} = \) the centerline of the map controls the proportion of errors
  \( P_i = \) error proportion of each sample or subgroup in each observation
  \( n = \) the number of the sample taken each time observation
  \( g = \) the number of observations made

c. While the upper control limit (BPA) and lower control limit (BPB) for the controlling map of the proportion of errors are:

  \[ BPA = \bar{P} + 3 \left( \sqrt{\frac{P(1-P)}{n}} \right) \]

  \[ BPB = \bar{P} - 3 \left( \sqrt{\frac{P(1-P)}{n}} \right) \]

- **Fishbone Diagram**
  The next step is to find the dominant causal factors for raw materials with a causal diagram or often referred to as a fishbone diagram. Factors causing the failure of raw materials are determined through verification of the types of damage. The next step is to find a solution to improve and minimize the emergence of these problems in the future (Jha, 2013).

  The causal diagram (cause and effect diagram) is also known as the Ishikawa diagram (Ishikawa diagram) or fishbone. Fishbone diagram analysis is a tool for analyzing business processes and their utilization (Bose, 2012).

  According to (Besterfield, 2009), the steps in making a cause and effect diagram are as follows:
  a. Identify the main problem first.
  b. Determine the main problem to the right of the diagram.
  c. Identify the main cause (major) as the source of the cause of the deviation a put it on the main problem diagram.
  d. Identify the additional cause (minor) as a cause of deviations and place them on the main cause diagram.
  e. Evaluate the diagram to determine the real cause of the deviation.

  Supporting cause
Quality Control of Raw Materials for Candied Carica Using P-chart Analysis and Fishbone Diagram

In determining the possibilities of factors that cause the failure of the product will be associated with various existing theoretical references, including human factors (man), tools and machines of production (Machines), methods of production processes (material), and work environment factors (environment).

RESULTS AND DISCUSSION

The process of controlling the quality of raw materials in Carica candied fruit is done by sorting out when the Carica fruit will be peeled. The activity was carried out to find out if there was damage to the raw material for making Carica candies. According to information obtained from CV. Yuasa Food Berkah Makmur, the standard of quality of raw materials for making candied Carica is applied, among others, in table 1. Testing the raw material of Carica fruit is carried out with the human senses so that it can be known directly if there is a deviation.

Table 1 Standard of Carica Fruit Raw Materials CV. Yuasa Food Berkah Makmur

<table>
<thead>
<tr>
<th>Raw Material Requirement</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aroma</td>
<td>Typical Carica fruit</td>
</tr>
<tr>
<td>Taste</td>
<td>Tasteless</td>
</tr>
<tr>
<td>Color</td>
<td>Yellow</td>
</tr>
<tr>
<td>Texture</td>
<td>Soft</td>
</tr>
</tbody>
</table>


Table 2 Amount of Failure of Carica Raw Materials January-June 2018

<table>
<thead>
<tr>
<th>Month</th>
<th>Total Raw Material Supply (Kg)</th>
<th>Amount of Raw Material Rejected (p_i) (Kg)</th>
<th>The proportion of Raw Material Failure (∑(p_i)) (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>January</td>
<td>6.742</td>
<td>196</td>
<td>2.91</td>
</tr>
<tr>
<td>February</td>
<td>9.229</td>
<td>253</td>
<td>2.74</td>
</tr>
<tr>
<td>March</td>
<td>12.060</td>
<td>249</td>
<td>2.06</td>
</tr>
<tr>
<td>April</td>
<td>10.071</td>
<td>287</td>
<td>2.85</td>
</tr>
<tr>
<td>May</td>
<td>8.291</td>
<td>200</td>
<td>2.41</td>
</tr>
<tr>
<td>June</td>
<td>9.132</td>
<td>181</td>
<td>1.98</td>
</tr>
<tr>
<td>Total</td>
<td>55.525</td>
<td>1.366</td>
<td>14.93</td>
</tr>
</tbody>
</table>

Source: Primary processed data, 2019
The analysis process from the tabulation results of Carica fruit raw material data in this study using Quality Control Statistics (SQC). In this study not all use all that is in statistical quality control, only used the type of tool that fits the problem to be solved using a control chart (control diagram) that contains line graphs that set the maximum and minimum limits to allow to find objects that are seen from boundaries of statistical data or not and (fishbone) that are used to find the root of the problem and the cause of the cause. The causal diagram will show the dominant factors causing failure that occur when testing the raw material for Carica candies.

Test the raw material of Carica fruit which is processed directly tabulated and analyzed using $p$-graph map $3\sigma$. From the results of the analysis, it can be seen whether the raw material is within the statistical access limit or not.

The total raw material tested from January to June 2018 is 55.525 kg Carica. Based on the table above, it can be seen that of the 55.525 kg of Carica tested for 167 days of testing, and there was 1.366 kg of broken Carica.

![Figure 1: Attribute Control Map P (p-chart) Amount of Failure of Carica Fruit Raw Materials January 2018](image)

In Figure 1, the $p$ (p-chart) attribute control map is rejected $3\sigma$ for the number of raw material failures for 26 days. The number of samples for testing fruit Carica raw materials during January 2018 was 6.742 kg (100% sample inspection). Based on the results of data analysis, testing determines the raw material is within the statistical access limit (in statistical control). The failed proportion of the average fruit raw material during January 2018 is 2.91 percent of the total raw material. Based on information obtained from the report on the results of the raw material of Carica fruit on the CV. Yuasa Food Berkah Makmur there are no Carica fruits that repair the damage so that all Carica fruits can be processed further.
Quality Control of Raw Materials for Candied Carica Using P-chart Analysis and Fishbone Diagram

In figure 2, a total of 28 days of testing of raw materials carried out during February 2018. The number of samples for testing raw materials during February 2018 was 9,229 kg (100% sample inspection). Based on the results of data analysis, testing determines the raw material is within the statistical access limit (in statistical control). The failed proportion of raw materials during February 2018 is 2.74 percent of the total raw material. Based on information obtained from the results of field reports in the field of raw materials Carica fruit at CV. Yuasa Food Berkah Makmur there are no Carica fruits that repair the damage so that all Carica fruits can be processed further.

Figure 2  Attribute Control Map P (p-chart) Amount of Failure of Carica Fruit Raw Materials February 2018

In figure 3, information from the results of field reports in the field of raw materials Carica fruit at CV. Yuasa Food Berkah Makmur there are no Carica fruits that repair the damage so that all Carica fruits can be processed further.

Figure 3  Attribute Control Map P (p-chart) Amount of Failure of Carica Fruit Raw Materials March 2018
In figure 3. Shows the P (p-chart) attribute control chart 3σ for the number of raw material failures. The number of samples for testing raw materials during March 2018 was 12,060 kg (100% sample inspection). There is one point that is out of bounds (UCL), which is 0.04 at observation to 22nd.

The proportion of failed raw materials on average during March 2018 is 2.06 percent of the total raw material. Based on information obtained from CV. Yuasa Food Berkah Makmur, the raw material that is not suitable because the raw material does not fit the criteria such as raw and rotten Carica fruit.

![Figure 3. Attribute Control Chart P (p-chart) for Number of Failure of Raw Materials March 2018](image)

In figure 4. Shows the P (p-chart) attribute control chart 3σ for the number of raw material failures. The number of samples for testing raw materials during April 2018 was 10,071 kg (100% sample inspection). There is one point that is out of bounds (UCL), which is 0.05 at observation to 25th. The proportion that the average raw material fails during April 2018 is 2.85 percent of the total raw material. Based on information obtained from CV. Yuasa Food Berkah Makmur, the raw material that is not suitable because the raw material does not fit the criteria such as raw and rotten Carica fruit.

In figure 5. Shows of the P (p-chart) attribute control chart 3σ for the number of raw material failures for 29 days. The number of samples for testing raw materials during May 2018 was 8,291 kg (100% sample inspection). Based on the results of data analysis, testing determines the raw material is within the statistical access limit (in statistical control). The failed proportion of raw materials during May 2018 is 2.41 percent of the total raw material. Based on information obtained from the results of field reports in the field of raw materials Carica fruit at CV. Yuasa Food Berkah Makmur there are no Carica fruits that repair the damage so that all Carica fruits can be processed further.

In figure 6. Shows of the P (p-chart) attribute control map is removed 3σ for the number of raw material failures for 24 days. The number of samples for testing raw materials during June 2018 was 9,132 kg (100% sample inspection). Based on the results of data analysis, testing determines the raw material is within the statistical access limit (in statistical control). The failed proportion of raw materials on
average during June 2018 is 1.98 percent of the total raw material. Based on information obtained from the results of field reports in the field of raw materials Carica fruit at CV. Yuasa Food Berkah Makmur there are no Carica fruits that repair the damage so that all Carica fruits can be processed further.
Identification of Cause of Raw Material Failure

Based on the results of the information obtained and data on damage to raw materials that have been completed, then prioritizing and the factors that cause damage to raw materials can be arranged into a causal diagram (fishbone). The Fishbone diagram of damage to raw materials is the result of the direct inspection in the field and interviews with related parties, including the head of the raw material reception and employees of the raw material peel.

The results of handling the dominant factors causing damage to raw materials into the causal diagram (fishbone) are presented in the figure below:

Figure 7 Cause Diagram Due to Damage of Raw Materials in 2018

Failure or raw material mismatch is caused by three main factors, namely human factors, raw material, and environment (the condition of the warehouse receiving Carica fruit raw material).

a. The human factor, which causes a lack of accuracy by farmers and warehouse employees when harvesting and sorting Carica fruit raw materials, the raw material of Carica fruit received by the warehouse of raw materials looking for fruit is not following with established standards. The incompatibility of the raw material of Carica fruit, which often occurs like fruit is still raw. The raw material for Carica fruit, which is brewed makes the raw material easy to rot and bruise because the storage system is stacked in the basket, which causes damage to the raw material of Carica fruit.

b. Factors of raw materials, caused by the raw material of Carica fruit, is not following with established standards. So there are still many raw ingredients of Carica fruit that are still raw, rotten, and bruised.

c. Environmental factors, the conditions in the warehouse where the raw materials are received are structured poorly, and these conditions can be a factor in the mismatch of Carica fruit raw materials because if the environment is not neatly arranged the raw materials will be easily damaged due to unsuitable place for raw material placement.

CONCLUSIONS AND RECOMMENDATIONS

Conclusions

Based on the results of the analysis using the p-chart 3σ control map on the observation of Carica fruit raw materials, the results were different at each process. Observation of Carica fruit raw material from January to June 2018 two months are outside the control limit (UCL), namely observations in
March and April. In March there is one point whose value is above the limit (UCL) which is 0.04, and in April there is one point whose value is above the limit (UCL) which is 0.05.

Based on the results of the analysis using fishbone, the types of causes that are the priority cause the raw material of Carica fruit is not following with the standard, which is caused by several main factors, namely human, raw material, and environment.

**Recommendations**

The suggestions that can be given to companies and other product processing industries need to be strict and regular to the receipt of raw materials from suppliers so that the level of damage to raw materials can be minimized.

**REFERENCES**


