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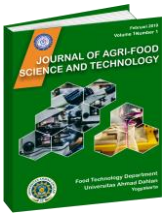

Quality Control Analysis of Carica Products Based on Sugar Content Parameters in PT AHA, Central Java

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ABSTRACT

PT AHA is a manufacturing industry company engaged in the processing of carica fruit food in the form of candied syrup (carica in syrup). On PT AHA every day will be carried out quality control to control the quality of carica in syrup. This study contributes to investigating the sugar content of carica in syrup. The sugar level was analyzed using a refractometer, dropper pipette, and toothpick, then the data obtained was analyzed using the SPC method (Statistical Process Control) and this test was carried out for 19 days. The results showed that there were 4 product samples outside the quality control limits, namely day 1 (22.1% Brix), day 6 (21.8% Brix), day 9 (18.3% Brix) and day 13(22.0 %Brix). Only 1 sample is found that exceeds the quality control limit, namely on day 1, while the others are still under control. The *difference in sugar content in carica products is possible because when entering sugar using a manual scale, errors can occur when reading the weight.*

1. INTRODUCTION

Currently, many industries, especially those engaged in the processing of agricultural products, are engaged in agriculture. Indonesia has various agricultural products, including fruits. PT AHA is one of the manufacturing industry companies engaged in processing carica fruit food in the form of candied syrup (carica in syrup).

In addition to its many benefits and high nutritional value, carica fruit is also a

commodity that spoils or rots quickly. This short shelf life has led to the development of methods aimed at extending or preserving the shelf life of fruits. PT AHA preserves fruit in candied form by adding sugar content to the fruit. Sugar content itself is the concentration of sugar contained in a functioning food or drink to hinder growth of microbes (Kusmiadi, 2003).

PT AHA applies it every day to quality control to control the quality of *carica in syrup* that are produced every day. It is important to understand that not all manufactured products are 100% identical in every manufacturing process. This is due to changes in the manufacturing process. The existence of deviations is natural and rational, but affects product quality and must be controlled. In general, statistical methods are widely used to control manufacturing processes. According to Heizer and Render (2015). Statistical Process Control (SPC) Is an action to monitor the process of corrective action, including the production, measurement, and methods of goods or services. According to (Godina & et al, 2016), the correct application and application of SPC is about factual decision making, developing quality awareness at all levels, systematic problem solving, experience gathering, and more: It can lead to improvements of its kind. Especially in manufacturing and regarding quality. According to Cheung & et al (2012) There are 2 types of data, there are variable and attribute control charts. And the data used in this study includes the variable control chart data group.

In this study, the measurement of sugar content in carica products will be carried out. sugar level According to Kee (2007) sugar content is the amount of sugar or glucose in a food or drink. The tool used is a refractometer. Refractometer is a tool to measure the level/concentration of solutes. For example, sugar, salt, protein, etc. The principle of operation of a refractometer, as the name implies, is to use light refraction (Mulyono, 1997). The unit of measurement used in refractometers is Brix%. Brix% represents the sugar content of an aqueous solution. Brix% sugar in an aqueous solution is 1 gram of sucrose in 100 grams of solution, expressing the strength of the solution as a percent by weight (% w/w) (Indartono, 2005). Tests were carried out to analyze the sugar content of candied carica produced by PT AHA.

2. MATERIALS AND METHODS

2.1. Materials

The materials used are 3 samples of carica products. The tools used in this study were a refractometer, a pipette, and a toothpick.

2.2. Research Methods

This research was conducted in several steps, firstly preparing tools and materials to be used. Secondly, the carica cup was opened using a toothpick and then the cup was pressed slightly so that the syrup could be released a little and then taken using a dropper. Thirdly, carica syrup is dripped on a refractometer as much as 2-3 drops and then the refractometer glass is closed. Lastly, observed rate sugar indicated on the tool and then recorded. This was repeated 3 times on 3 different samples.

Then done calculation of UCL, LCL, CL, and standard deviation values are obtained from the calculation results using the following formula:

$$UCL = CL + (3 \times standard\ deviation)$$
$$LCL = CL - (3 \times standard\ deviation)$$

$$CL = \frac{x}{k}$$

$$S = \sqrt{\frac{\sum_1^n \ (Xi - \underline{X})}{n-1}}$$

With that statement Upper Limitor upper limit denoted by UCL and Lower Control Limitor the lower limit is denoted by LCL.Linear controlsor denoted by CL is the middle value, obtained from $\bar{X}$ (xbar/mean) of each sample divided by k (number of samples). The standard deviation is denoted by S obtained from the sum root xi (data value i) minus $\bar{\bar{X}}$ (x double bars/ overall average) squared then divided by n (number of samples) minus one.

3. RESULT AND DISCUSSION

Measurement of sugar levels which is done on the PT AHA is one of the quality control activities carried out every day after production activities. This measurement of sugar content aims to control whether the product is in accordance with the standards set by the company before the product is marketed. Data collection was carried out for 19 working days from 18 March to 9 April 2022 so that the data used is data primary. In accordance with the theory according to Burhan 2008 primary data is data obtained by the researchers themselves from the object under the study through observation, interviews or experiments.

These data will later be observed deviations from the expected measurements but are still below the upper limit / UCL (Upper Control Limit) or above the lower limit / LCL (Lower Control Limit) is still considered a good product. If the data is outside the upper and lower limits, it is necessary to revise the control chart so that the measurement data will be within the control limits (Montgomery, 2005).

The process of calculating sugar of levels in PT AHA uses a 32% manual refractometer brix. The results obtained from the measurements are the percentage of dissolved solids in the test solution. For example, a test conducted using a 32% brix manual refractometer yielded 21.0% brix, meaning that 100 grams of solution contains 21.0 grams of dissolved dry solids (Atago, 2000). In order to obtain data on sugar content in Candied carica products as shown in Table1. From the data in Table 1, the results of calculating the average sugar content in carica products are 20.188% Brix. The average value will also be used later as (CL) or the middle value on the quality control chart. After doing calculations using the formula above, the UCL and LCL values are 21.419 and 18.957 with a standard deviation of 0.63. Furthermore, data analysis was carried out using a control chart which is shown in Figure 1.

From the quality control chart shows that there are several products that are not within the control limits, because there are points which went out of control, namely on day 1 (22.1% Brix), day 6 (21.8% Brix), day 9 (18.3% Brix), and day 13 (22.0% Brix). The products produced on days 1, 6 and 13 had sugar levels that were above the upper control limit, while the product of carica which were produced on day 9 had sugar levels below the lower control limits. There are circumstances out of control. This is due to several things, namely not being careful when entering the ingredients, also the measuring tool used is still in the form of manual scales which allows errors to occur when reading the scales.

Table 1. Sugar content in the carica product

Day	Sugar content (% Brix)			Average
	1st replication	2nd replication	3rd replication	
1	22.2	21.8	22.3	22.1
2	19.3	20.0	19.8	19.7
3	19.4	19.3	19.3	19.3
4	19.4	20.0	20.1	19.8
5	21.4	20.4	21.4	21.1
6	21.2	20.9	23.4	21.8
7	19.0	20.2	19.2	19.5
8	20.1	20.3	20.2	20.2
9	18.4	18.2	18.3	18.3
10	20.4	18.3	19.3	19.3
11	20.0	19.2	19.4	19.5
12	21.4	21.3	21.4	21.4
13	22.3	22.2	21.4	22.0
14	20.3	18.2	19.0	19.2
15	19.4	19.3	20.2	19.6
16	19.3	19.1	19.0	19.1
17	20.2	20.0	20.3	20.2
18	21.3	21.0	20.4	20.9
19	20.4	21.0	20.2	20.5
Average				20.188
Deviation standard				0.63
UCL				21.419
LCL				18.957

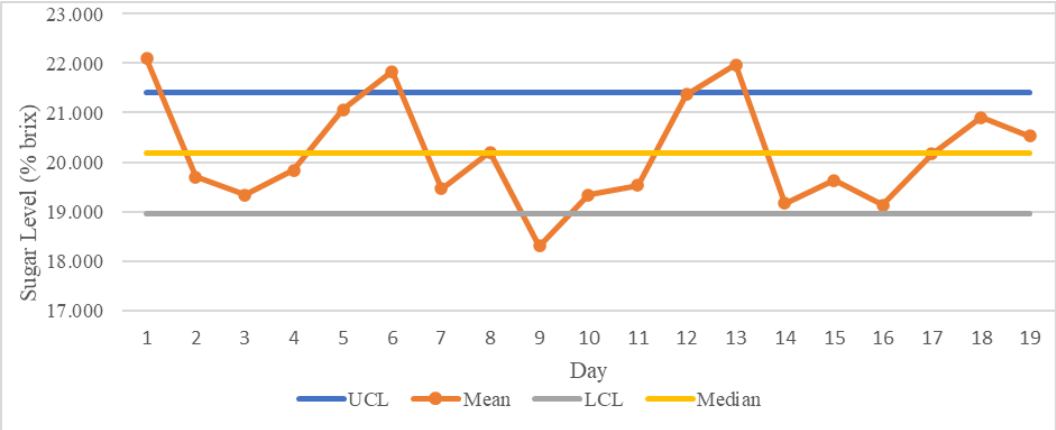

Figure 1. Quality control chart of carica's sugar content

Therefore, an analysis is also carried out based on the standards set by the company. The results of the analysis are depicted in Figure 2.

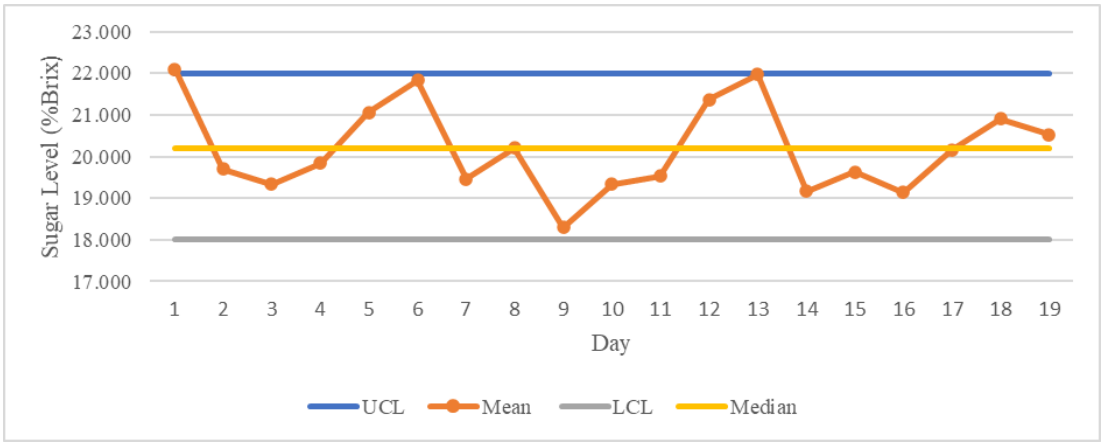

Figure 2. Quality control chart of carica's sugar content standard in PT AHA

PT AHA set a control limit on sugar content at the beginning after production of 22% with a lower control limit of 18%. From the quality control chart above it was found that some data were happening at a moment outside the control limits, namely on day 1 which had a sugar content value of 22.1% Brix. The difference in sugar levels in carica products could be due to human error, because when entering the main ingredient (sugar), it used manual scales which resulted in reading the weight of the scale.

4. CONCLUSIONS

The average sugar content of the product carica for 19 days of testing was 20.188% Brix. There were 4 samples that were outside the quality control limits, namely day 1 (22.1% Brix), day 6 (21.8% Brix), day 9 (18.3% Brix), and day 13 (22.0% Brix), but when analyzed using the company's standard upper control limit (UCL), samples of carica products only found 1 sample that exceeded the quality control limit, namely on the 1st day, while the other samples were still under control.

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