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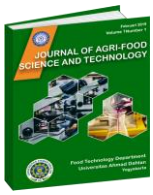

Quality Control of The Manufacturing Process of Sweet Bread in PT XYZ Yogyakarta

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ABSTRACT

Quality control is essential in the production line to ensure the quality of the final product. The quality control team ensure the standard of the produced products. This research aims to explore the quality control process in the production of sweet bread in PT XYZ and to determine the major defect of the product. Data were collected through interviews and a literature study. Pareto chart, control chart, and Fishbone diagram were used to analyze the data. These methods identify the kind of defects in the product and understand the process of controlling product quality. The results show that the quality control process had been carried out. However, some product defects were found, such as burned bread (15%), leakage (15%), and sticking (13%). Defect products might be due to some kind of factors such as human error, method production, and the equipment and materials used.

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1. INTRODUCTION

Bread is produced through a fermentation process by yeast (Saccharomyces cerevisiae). The materials used are flour, water, salt, milk or milk powder, fat, emulsifier, and toppings (chocolate, cheese, raisins, and so on) (Haryono,1992). Some bread is enriched with the addition of other nutrients such as beta carotene, some kinds of vitamin B and minerals. Sometimes, certain amino acids are added to improve the quality of bread. Bread Protein is up to 9.7%, higher than rice (7.8%). The starch content of the bread is higher than rice too. Rice has only 4-9% starch, but the bread has 13%. Four slices of bread are equal to a plate of rice in terms of calory (Jenie, 1993). The material of bread production consists of the raw materials and the supporting materials. The raw materials of bread production are flour, water, yeast, and salt. The supporting materials are used to improve the quality of

bread characteristics. These supporting materials are shortening, bread improver, skim milk, eggs, sugar, bread filling, and flavouring. Anti-oxidants (ascorbic acid, bromic) and anti-moulds (potassium propionate, calcium phosphate) are added to extend the shelf life (Kamarijani, 1983).

The quality of bread is affected by the raw materials and its manufacturing process (Moehji, 1971). Good quality of produced bread can be achieved by the use of the good raw materials and the production processes that comply with standards. The materials are good when they follow the production requirements. The manufacturing equipment must be selected and prepared (Mudjajanto, Eddy, and Noor, 2004). Quality control of the production process is carried out by observing and recording all matters related to the production process. Starting from the quality criteria of raw materials, equipment performance, the ongoing production process and the final product produced. If deviations are found during the production process and need to be identified, confirmed, or reported, the production process can be stopped under company procedures. The workplace is maintained according to workplace maintenance standards. Waste management is also included in quality control supervision. How procedures and processes for handling waste in the industry need to be documented. The resulting information is recorded on the form, products that do not comply with standards need to be reported to maintain product quality (Subarna, 1992). This research aims to explore the quality control process in the production of sweet bread in PT XYZ and to determine the major defect of the product.

2. MATERIALS AND METHODS

2.1 Tools and Materials

Instruments used for bread production were a stainless table, proofing, deck oven, combi oven, mixer, freezer, dough divider, rounding machine, scale, dough sheeter, breadline machine, baking tin, dispenser, gallon, dough box, doughnut cutting, plastic basin, and trolley shelf. Materials used were flour (Cakra Kembar and Segitiga Biru), yeast (SAF instant), salt, sugar, bread improver, UHT milk, margarine, chicken eggs, whipping cream, bacom A100, ice cubes, unsalted butter, and topping or filling.

2.2 Research Methods

Several stages to solve the problems are, (1) field observation, conducted directly in the field. This direct observation was done in the form of manufacturer observation and a study of the process flow of the control quality of raw materials to final products, (2) interview, exerted in the form of communication or dialogues through which information was gleaned. The staff were interviewed, (3) the literature study, was executed by reading and apprehending lecturing power points and seeking out other sources from the internet. These activities were performed to comprehend and complete research data, (4) data collection, which was taken place by collecting data directly from relevant sources, and (5) conclusion, drawn after data observation and collection.

3. RESULTS AND DISCUSSION

3.1. Quality Control of the Process

Quality control of the bread manufacturing process in PT XYZ encompassed the following activities:

1. Examine the kneading duration of the dough until smooth, elastic (not sticky to the mixer). Over kneading would breed bread in a very large volume and not chewy. Insufficient kneading would bring about not elastic bread dough which would fall apart when the dough was baked or when it was rising.
2. Monitoring the dough during the kneading process, maintaining its hygiene.

3. Ensuring that bread was set within a 4-cm distance to another, preventing them to stick to each other and bringing on a good shape when the bread was rising.
4. Controlling the proofing process to make the dough rise perfectly for 50 minutes an hour at 55-60°C.
5. Controlling the baking process and ensuring if the oven fire was still on at 8-10 minutes at 170°C.

3.2. Final product Quality

To obtain quality final products, we needed to do the sorting. Through sorting, we could nurture the quality desired by consumers. Sorting was aimed to investigate the products and sort out quality products and low-quality ones. Products with low quality are falling apart, not rising, having black spots, and burned.

3.3. Final Product Requirements

The manufacturer determined the quality requirements of the final products produced before they were marketed. In PT XYZ, the requirements were:

1. Soft texture
2. Yellowish-brown colour
3. Intactness
4. Uniformity
5. Soft fibre
6. Rising in volume

3.4. SQC Application in Quality Control

The Pareto chart was used to observe data on types of defects in PT XYZ in October-November 2021. The dominant types of defects were then figured out. Table 1 exhibits types of defects ardently found in bread.

Table 1. Types of Defects Found in October-November 2021

No.	Type of Defect	Number of Products with Defects (pcs)	Percentage	Cummulative Percentage
1	Inappropriate size	182	33%	33%
2	Poor shape	114	21%	54%
3	Burned	90	17%	71%
4	Leaking	64	12%	83%
5	Sticky	42	8%	90%
6	Falling apart	30	6%	96%
7	Undercooked	12	2%	98%
8	Not rising	5	1%	99%
9	Without topping	5	1%	100%
10	Flour sticking to the bread	1	0%	100%
	Total	545	100%	

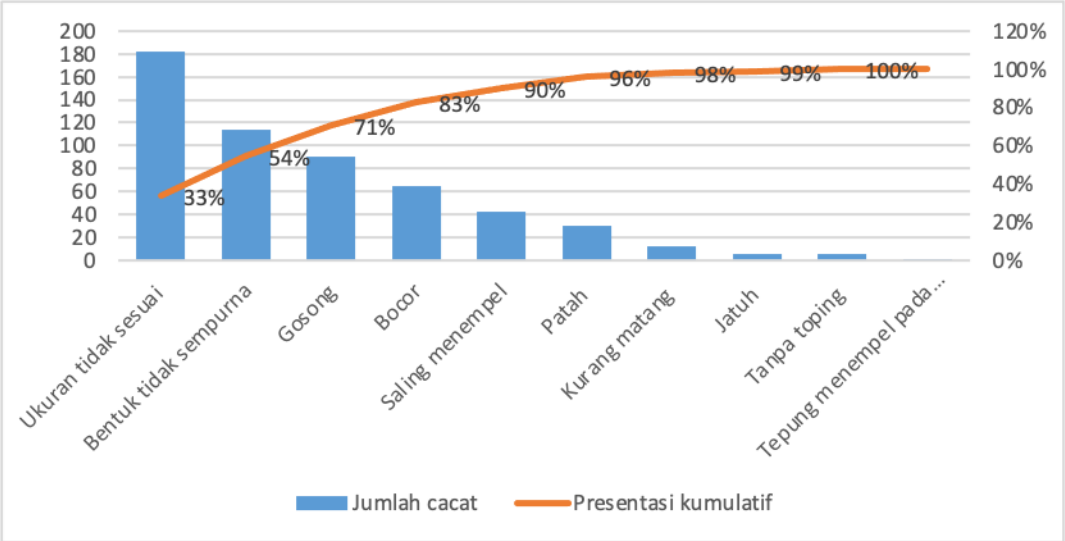

Figure 1. Defect profile of bread at PT XYZ

Based on the Pareto chart, the dominant types of bread defects were inappropriate size (182 pieces at a cumulative percentage of 33%), poor shape (114 pieces at a cumulative percentage of 54%), burned (90 pieces at a cumulative percentage of 71%), and leaking (64 pieces at a cumulative percentage of 83%). Accordingly, the manufacturer should study the causes of product failures which might escalate production costs.

A control chart constituted the technique of making a statistic graphic whose values were measured by plotting characteristics of a certain quality. It ensured whether a manufacturing process was under statistical control. It was conducted by determining control limits, namely:

1. Upper Control Limit (UCL): the upper supervision limit of the variation of defect levels during sample checking.
2. Central Line (CL): the line marking no violation during sample checking.
3. Lower Control Limit (LCL): the lower supervision limit of the variation of defect levels during sample checking.

Formulas to measure CL, UCL, and LCL were (Besterfield, 2009):

1. Measuring the proportion of defects

$$p = \frac{np}{n}$$

Description:
np = the number of product failures within a sub-group (day -)
p = the number of products checked within a sub-group (day -)

2. Measuring the Central Line (CL)

$$CL = \bar{p} = \frac{\sum np}{\sum n}$$

Description:
$\sum$ np = the total number of products with defects
$\sum$ n = the total number of products checked

3. Measuring the Upper Control Limit (UCL)

$$UCL = \bar{p} + 3\frac{\sqrt{\bar{p}(1-\bar{p})}}{n}$$

Description:
p = the mean of product non-conformity
n = the amount of production

4. Measuring the Lower Control Limit (LCL)

$$LCL = \bar{p} - 3\sqrt{\frac{\bar{p}(1-\bar{p})}{n}}$$

Description
p = the mean of product non-conformity
n = the amount of production

Using the formulas, we procured the proportion of defects, CL, LCL, and UCL in October as follows:

1. The proportion of defects = product defects/day : the amount production/day.
2. CL or p = the total number of products with defects : the total number of products checked = 288 : 41930 = 0.006868591.
3. The value of 1 - p = 1 - 0.006868591 = 0.993131409.
4. $\overline{UCL}$ (the total of the mean of UCL value) = 0.013871101 from the total UCL : the total observation = 0.43000413 : 31
5. $\overline{LCL}$ (the total of the mean of LCL value) = -0.00013392 from the total LCL : the total observation = -0.0041515 : 31.

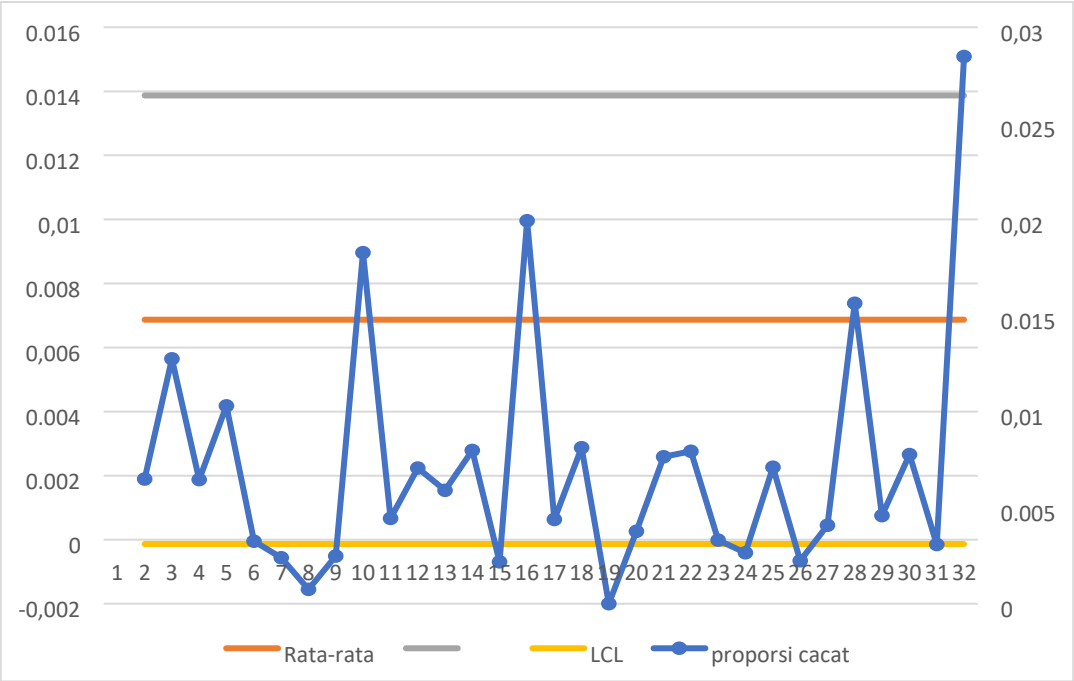

Figure 2. Control Chart for October 2022

Predicated on Figure 2, some data were outside the control limit defined. In addition, some data were outside both upper and lower control limits. The production data came about days 7, 8, 9, 15, 20, 24, and 26. Sudden changes of the dots, which led to the outside of the central line and came with an irregular pattern were as the amount

of daily production and the number of daily products with defects were imbalanced. This indicated a violation of quality control of sweet bread products. The violation was brought on by labour, raw materials, machine, work methods, environment, and other factors. The manufacturer should review its production. It had to ensure that the production carried out remained in control and efficient. Hence, there was no adverse influence on production costs.

Using the aforementioned formulas, we acquired the proportion of defects, CL, LCL, and UCL in November as follows:

1. The proportion of defects = product defects/day : the amount production/day.
2. CL atau p = the total number of products with defects : the total number of products checked = 256 : 44556 = 0.005745579.
3. Nilai 1 - p = 1 - 0.005745579 = 0.994254421.
4. UCL (the total of the mean of UCL value) = 0.011818483, from the total UCL : the total observation = 0,35455449/30
5. LCL (the total of the mean of LCL value) = -0.00032733, 00013392 from the total LCL : the total observation = -0.0098198/30

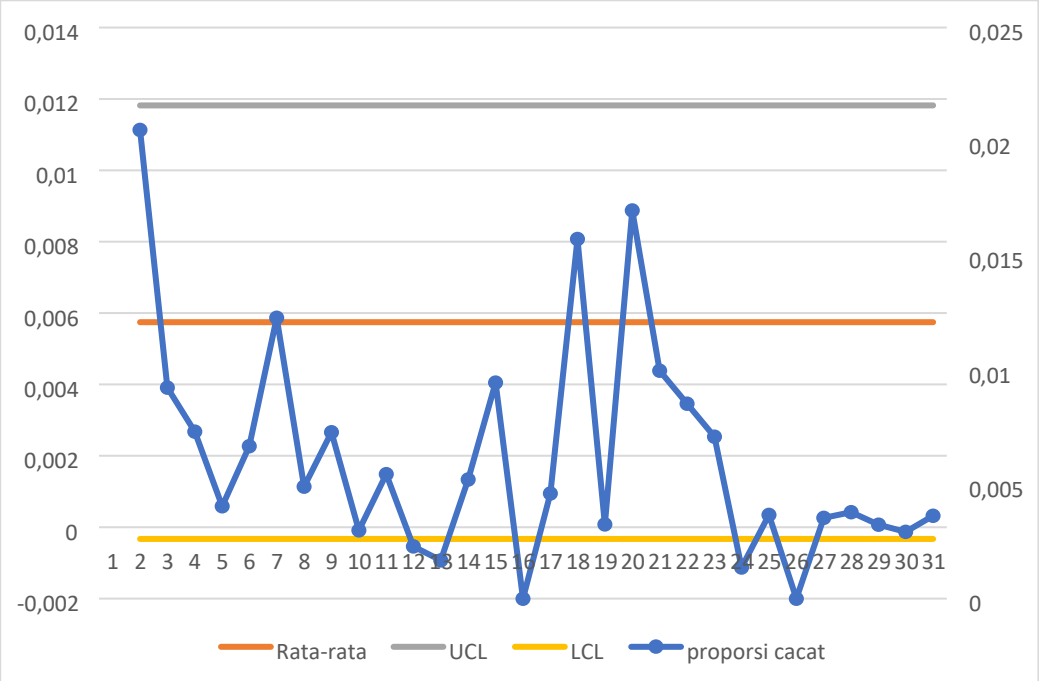

Figure 3. Control Chart for November 2022

As manifested in Figure 3, some data were outside the control limit defined. In addition, some data were outside both upper and lower control limits. The production data broke out on days 12, 13, 16, 24, and 26. Sudden changes of the dots, which led to the outside of the central line and came with an irregular pattern were as the amount of daily production and the number of daily products with defects were imbalanced. This indicated a violation of quality control of sweet bread products. The violation was brought on by labour, raw materials, machine, work methods, environment, and other factors. The manufacturer should review its production. It had to ensure that the production carried out remained in control and efficient. Hence, there was no adverse effect on production costs.

As suggested in Figure 4, factors causing defects in bread were man, materials, methods, machines, and so forth. The factors are explained as follows:

1. Man or Laborer

Human resources were the most paramount resources for the manufacturing industry. In so doing, the manager should seek to realize positive behaviours among the staff (Umar, 2002). As pointed out in Figure 4, bread defects were possible results of labourer carelessness, unclear instructions among labourers, and a lack of human resources. The causes led to the bread of poor quality. It might be either burned, have holes, not rising, short, thin, or sticky. To overcome these issues, labourers should be provided with clear instructions. Besides, the manufacturer should reconsider and add the number of labourers. These actions would likely allow easy and well-run coordination.

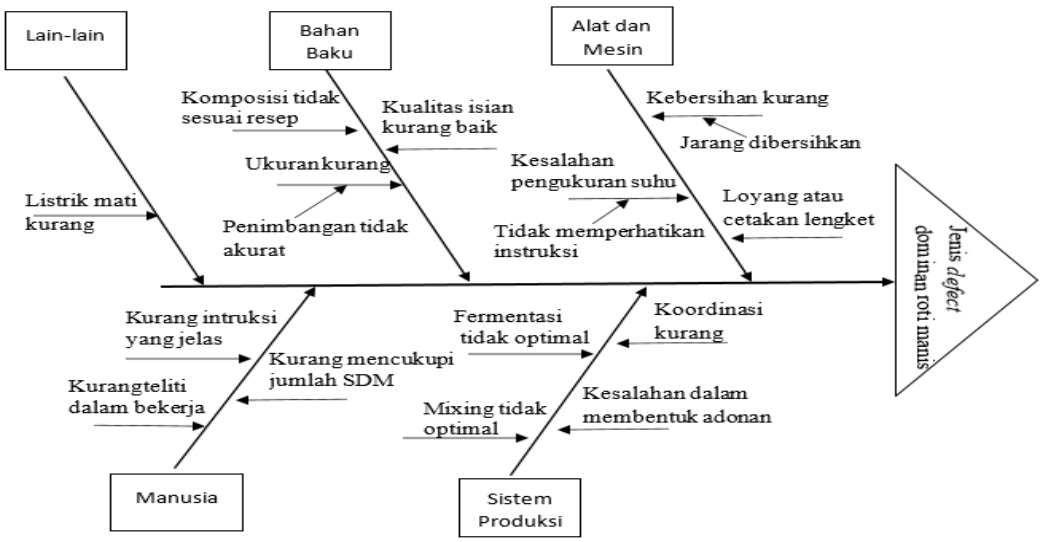

Figure 2. Fishbone Diagram

2. Material

Raw materials were also of paramount importance in the manufacturing process. Any raw materials used by the manufacturer should be on the supplier's list. Figure 2.5. presented causes of product defects, i.e., poor quality of filling, inappropriate composition, and inappropriate bread size or shape. Consequently, the products produced were burned, dissimilar in shape, leaked, or came with burst filling. Bread in dissimilar shapes was indicative of product defects because of the materials used. Furthermore, low-quality flour would generate low-quality bread. Additionally, defects were also impacted by materials. Low-quality raw materials would induce product defects.

3. Method

Innumerable bread products with defects could also be produced by a lack of coordination, poor mixing process, poor fermentation, and mistakes in making the dough. These events might contribute to a large number of bread products with defects and negatively influence bread quality. That being so, labourers' cautiousness and good understanding were two aspects warranted in bread making process that kept pace with the manufacturer's standards.

4. Machine

Machine or equipment used in bread making could also contribute to a large number of bread products with defects. In Figure 4, the defects were because by unhygienic equipment used, sticky baking tins, and mistakes in regulating the equipment temperature. Some defects under machine or equipment factors were burned, chunked, and dent bread. Defects found in bread certainly predisposed its quality. To

reduce the defects, equipment hygiene should be maintained by washing it periodically and regularly. Washing the equipment was suggested before it was very dirty or smelly. Additionally, to tackle any burned product problem, labourers should be more meticulous in regulating temperature.

4. CONCLUSIONS

The standards required bread to be (1) soft, (2) yellowish-brown in colour, (3) intact, (4) uniform, (5) soft in fibre, and (6) rising in volume. The dominant types of defects found in sweet bread produced by PT XYZ were inappropriate size, poor shape, burnt, falling apart, and leaking. The defects were due to mistakes in regulating oven temperature, sticky baking tins, poor hygiene, poor quality of bread filling, bread composition not on pace with the recipe, lack of coordination among labourers, mistakes in kneading, poor fermentation preventing the bread from rising, lack of rigorousness among labourers, and an insufficient number of labourers.

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