Journal of Agri-Food Science and Technology

Journal homepage http://journal2.uad.ac.id/index.php/jafost

Quality Control of Dry Noodle Product Processing in Semarang Central Java

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ARTICLE INFO

Keywords

Quality control; pareto chart; control chart; fishbone diagram

10.12928/jafost.v2i1.4775

ABSTRACT

Quality control is needed to produce quality products. Quality control is aimed at reducing defects in production results. In this study, we focus on the analysis of the types of defects, the number of defects, and the causes of defects in dry noodles, including the attributes of moisture content, shape, and packaging. The population in data collection was all dry noodle. The sampling method for the moisture content attribute was purposive sampling. Data collection methods by observation, interview, and literature study. Data were analyzed using pareto chart, control chart (p-chart), and fishbone diagram. The control chart showed four points of defective products that were beyond the control limits and six points that were within the control limits. Finally, the fishbone diagram demonstrated that two dominant factors causing defects in dry noodle products were machine and the processing method.

1. INTRODUCTION

Indonesian staple foods are rice, corn, sago and tubers. People's dependence on rice is very high. To achieve food security to meet basic food needs, alternative staple food products should be developed (Kumalasari et al., 2017). Indonesia is the second-largest consumer of instant noodles after China. In 2019, the consumption of instant noodles in Indonesia reached 12.520 billion packs and in 2020, it increased to be 12.640 billion packs. Meanwhile, the world's consumption of instant noodles in 2020 reached 116.650 billion packs (World Instant Noodles Association, 2021). This is an opportunity for Indonesia to

increase instant noodle exports to the global market.

Dry noodles are noodles which have undergone a drying process until the moisture content is 8-13% (Budiarti *et al.*,2011). Dry noodles with a high moisture content have a shorter storage life (Nugrahawati, 2011). As one of the alternative foods as a substitute for rice, dry noodles have a higher carbohydrate content of 76.3 g/100 g if compared to rice's, which is 39.9 g (Mulyadi *et al.*,2015)

The company has established standards that can be used as product benchmarks. In the industry, quality control is important (Pereira & Spinwall, 1991). Quality control begins with the handling of raw materials to the final product. In order to generate quality products, quality control in an industry requires the application of appropriate proceduress (Edith & Ochubiojo, 2012). Controlling the moisture content of dry noodles is important. The moisture content of food will affect the food resistance to microbial attack, so if it does not fulfil the specified conditions, it causes the growth of bacteria, molds, and yeasts. The drying process removes or reduces the moisture content of a material. The factor that causes changes in the product is the determinant of the product's critical point in connection with the storage period. This critical point will lead to a reduction in product quality during the product distribution to product consumption processes (Brennan, 2006).

2. LOCATION AND METHODS

2.1 Location

The research was carried out in Semarang Central Java from March-April 2021.

2.2 Research Methods

The data collection methods used were (1) observation, namely direct observation conducted from the beginning until the end of the production processes accompanied by the production head, (2) interview done by directly asking the field supervisor and employees for information about the company and specific topics, and (3) literature survey executed to support and complete data.

2.2.1 Moisture content

SNI 8217:2015 was the moisture content standard used in this research. The moisture content of dry noodles having undergone the drying process was observed to collect data on its defects. Water concentration was measured using a Grain Moisture Meter. Purposive sampling was carried out, bringing about 48 pieces of dry noodles dried in one drying process. The noodle samples were employed to analyze the moisture content characteristic. Purposive sampling was a sampling technique that selects samples by criteria (Sugiyono, 2008). In sampling, noodles at the front of the row of each food dehydrator rack were chosen as they are the furthest away from the drying fan on the machine under the assumption that the noodles would likely have more than 13% moisture content.

2.2.2 Packaging attribute

SNI 8217:2015 was used for product packaging quality control. Defect data collection on the packaging attribute was during the sealing process. Criteria for the packaging defect attribute were package leakage, the checking method of packaging pressing, melted plastic package, and unclearly stated production code and expiration date.

2.2.3 Shape attribute

To achieve customer satisfaction, the company should know the attributes of the products and services that consumers needed, i.e., physical and non-

physical attributes (model, shape, quality, price, colour, taste, durability, security and warranty of the products used) (Wartaka & Sumardjono, 2020). Physical observation of noodles after drying was conducted to collect data on errors in the shape of noodles. The defect criteria were non-rectangular noodles, folded noodles, and damaged noodles.

2.2.4 Data Analysis

The collected data were analyzed using a Pareto chart, the control chart (p-chart), and the fishbone diagram. The analysis referred to Heizer & Render (2011).

3. RESULTS AND DISCUSSION

Flour with high starch damage and small particle size required more water absorption during noodle production, and raw noodles produced from that flour had higher breaking stress. Starch damage correlated with dark colour in soft wheat noodles, and the damage would increase by five times in ball-milled, soft wheat flours (C.W., 1985). Table 1 shows observational data of products that were undesired or had defects in the processing.

Table 1. Data observations of defect product

No	Total (pcs)	Defect (pcs)		
		Moisture content >13%	Shape	Packaging
1	384	12	0	0
2	549	10	0	3
3	543	8	0	0
4	590	20	2	5
5	578	13	0	0
6	384	16	1	0
7	255	0	0	1
8	384	8	0	0
9	576	17	3	0
10	288	8	0	0
	Total	112	9	6

3.1 Pareto Chart

According to Figure 1, in the 112 defect products found, the dominant defect was the products' high moisture content at a percentage of 88 %, followed by packaging and shape defects at percentages of 7% and 5%, respectively.

Table 2. *Defect data of dry noodle products*

Attribute	Total (pcs)	Percentage	Cumulative presents
Moisture content >13 %	112	88%	88%
packaging	9	7%	95%
Shape	6	5%	100%
Total	127	100%	

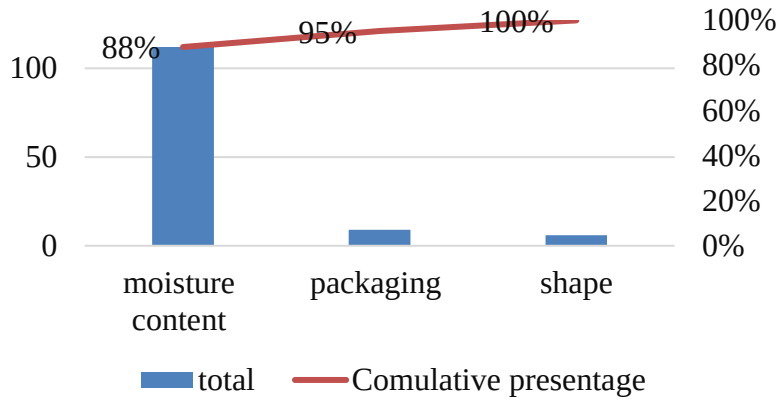

Figure 1. Pareto chart defect product of dry noodle products

3.2 Control Chart

Table 1 shows the defect data on dry noodles for ten days of production in April 2021. A p-chart analysis was carried out on the data by calculating the CL (Central Line), UCL (Upper Control Limit), and LCL (Lower Control Limit). Table 3 shows the results. Data in Table 3 could be presented using the control chart as in Figure 2.

Table 3. Results of LCL, CL, UCL

No.	Production (pcs)	Defect (pcs)	proportion of defects	LCL	CL	UCL
1.	384	12	0.03	0.02	0.03	0.04
2.	549	13	0.02	0.02	0.03	0.04
3.	543	8	0.01	0.02	0.03	0.04
4.	590	27	0.05	0.02	0.03	0.04
5.	578	13	0.02	0.02	0.03	0.04
6.	384	17	0.04	0.02	0.03	0.04
7.	255	1	0.00	0.02	0.03	0.04
8.	384	8	0.02	0.02	0.03	0.04
9.	576	20	0.03	0.02	0.03	0.04
10.	288	8	0.03	0.02	0.03	0.04
Total	4531	127				

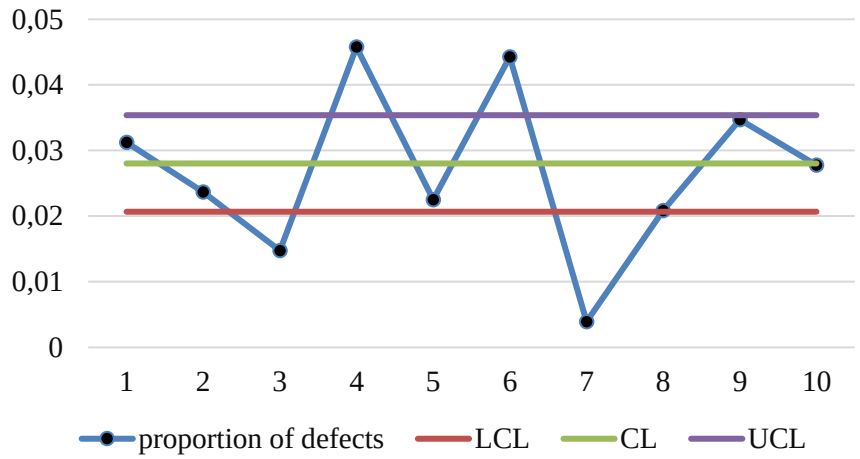

Figure 2. Control chart (p-chart) defect product of dry noodle products

According to Figure 2, dry noodle production in April 2021 had four points that were upper the control limit and six points that were within the control limit. Points that exceeded either UCL or LCL were caused by a large number of defective products produced. With regard to the proportion of defects with the highest proportion was 0.04576 and the lowest proportion was 0.003921. The fishbone diagram was used in the next analysis to determine factors that caused defects.

3.3 Fishbone Diagram

3.3.1 Moisture contents

According to Figure 3, high moisture content in dry noodles was caused by several factors, namely:

1. Machine was the main factor of high moisture content value in dry noodles. The factor was brought on by power outages so the machine stopped. The temperature was not aligned with the specified standards. This might be caused by a lack of maintenance.
2. Human factors were caused by a lack of accuracy. For example, operators did not properly monitor machine performance, were sleepy, or felt tired and bored.
3. Method factor was caused by a lack of coordination among workers, which could engender certain incorrect techniques in the production process, such as, the use of incorrect temperature and time settings. The noodle was excessively thick and uneven, causing some of the noodles to dry perfectly while some remained wet.
4. Environment factors could be caused by a hot room temperature because the air conditioner did not work or noisy environment as a result of the sound of machines.
5. Raw materials used in the formulation process exceeded the standard, resulting in a high moisture content in the dough.

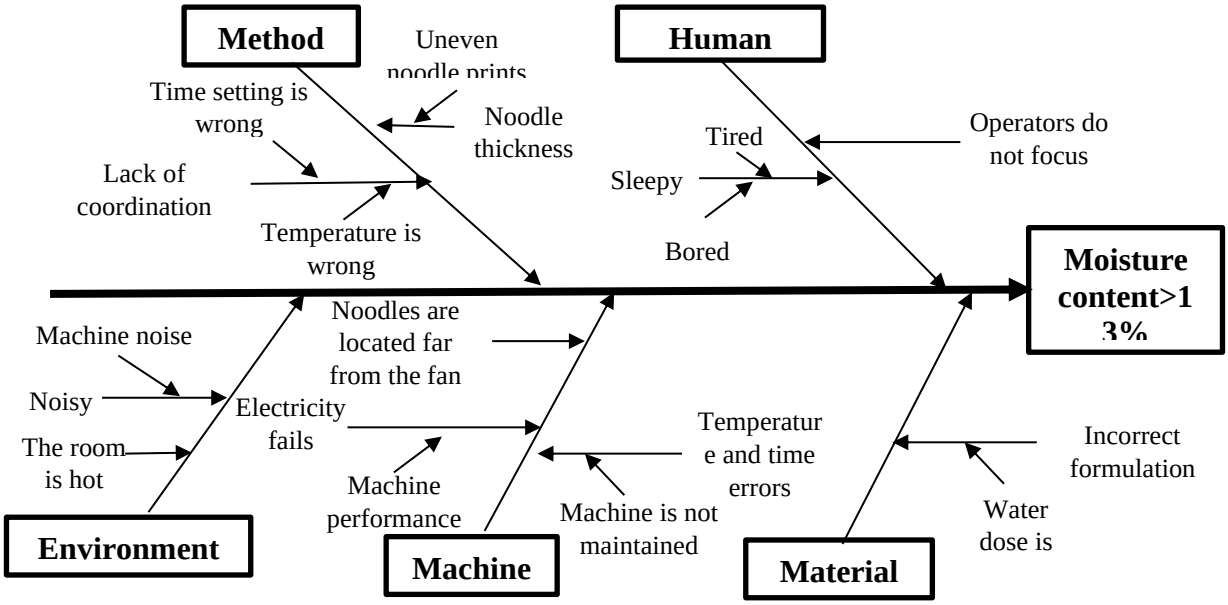

Figure 3. Fishbone diagram of moisture content >13%

3.3.2 Packaging

According to Figure 4, several factors contributed to product packaging defects were:

1. Human factors played a critical role in the packaging process. Damage in the packaging process because of human factors was mainly caused by the operator paying no attention to machine performance, not focusing on what was done, and being sleepy due to boredom or tiredness.
2. In relation to method factors, packaging defects could be caused by a lack of coordination between workers when they were shifting works or folded packaging as a result of a lack of packaging tightening during the packaging sealing process so that the package edges were not symmetrical.
3. Machine factors were caused by incorrect temperatures. High temperature caused the plastic package to melt, resulting in packaging leakage and damage. Meanwhile, low temperature caused the package not to stick perfectly. Because the digital control panel was damaged, the temperature used did not match the temperature displayed on the temperature display. Finally, a lack of machine maintenance could also generate machine damage.
4. Environment factors were caused by a hot room temperature because the air conditioner did not work or the power went out. Environmental factors could also be fueled by noise, such as the sound of machines.

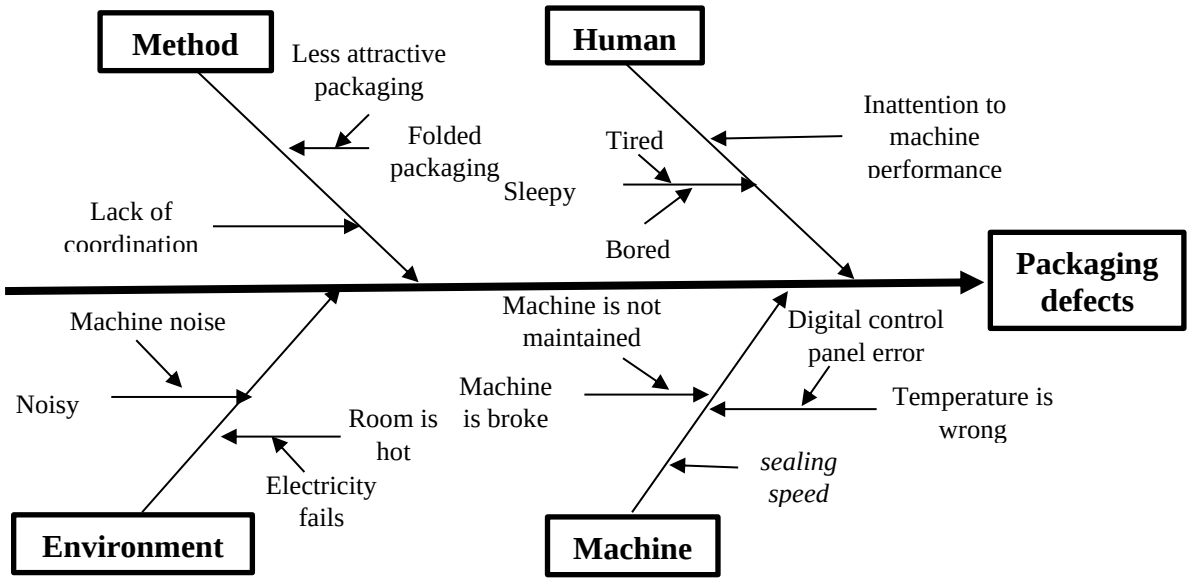

Figure 4. Fishbone diagram of packaging defects

3.3.3 Shape

According to Figure 5, several factors that affected shape defects were:

1. Human factors were caused by a lack of accuracy, not focused workers, tiredness, and boredom which induced sleepiness.
2. The method factor appeared in the making process of noodles, that the maker did not press the noodle adequately and the noodles to be cut were cold, resulting in imperfect ones.
3. Machine factors were caused by high temperature, producing very dry noodles, which were brittle and accordingly, easily damaged when the noodles were transferred for packaging and poor arrangement of the noodles when drying, causing them to fold.
4. Environment factors were caused hot temperature caused by a narrow production room that allowed no air to enter, turned-off/unworked air conditioner, and noise similar to the sound of the machine.
5. Raw material factors were caused by poor raw material formulation, which caused unstandardized noodle dough.

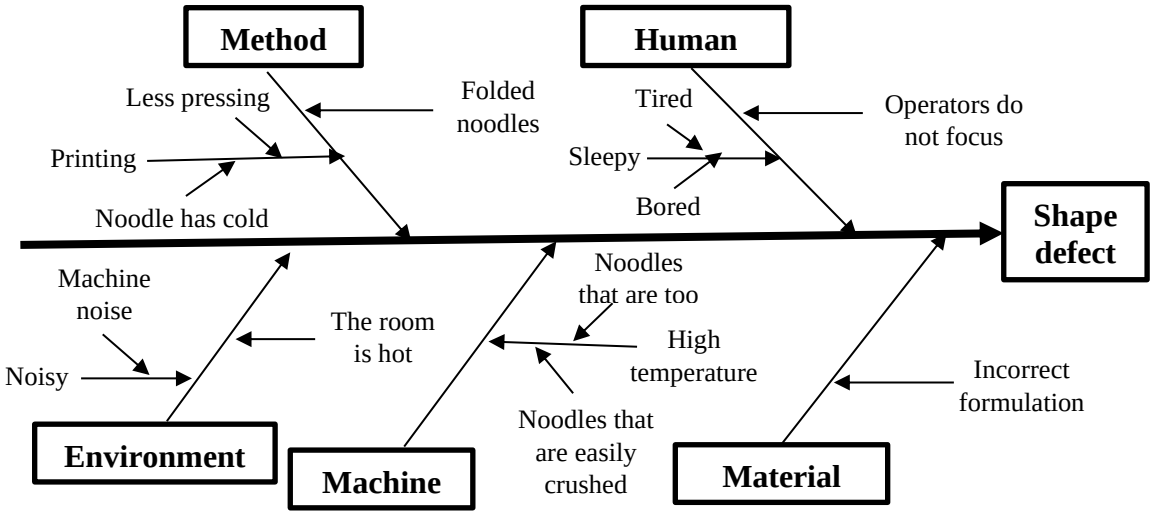

Figure 5. Fishbone diagram of shape defect

4. CONCLUSIONS

The conclusions from this practical work were that according to the results of the analysis, three categories of defects in dry noodles were moisture content, shape, and packaging. The results of the Pareto chart analysis of dry noodles exhibited 112 pieces with defects in the moisture content by 88%, nine pieces with defects in the product packaging attribute by 7%, and five pieces with defects in the shape attribute by 5%. Furthermore, based on the results of the Fishbone diagram analysis, factors that caused defects in dry noodles are humans, environment, methods, raw materials, and machines. Machines were the most influential factor in the moisture content and packaging attributes, while method was the most influential factor in the shape attribute.

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