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Observation of plastic packaging defects in halal chili sauce

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ABSTRACT

Food packaging is a material used to contain or wrap food, both in direct and indirect contact with food. The packaging process is closely related to product quality to ensure that the process that occurs will produce products according to the specified standards and can prevent damage or packaging defects. The relationship between packaging defects also has an impact on consumer decisions when they want to buy a product. This is because of the first impression that consumers get after seeing the shape of the product packaging being sold. This study aims to determine the process that produces the most plastic packaging defects in the chili sauce production process and the conformity of plastic packaging quality standards with SNI. The process of observing the plastic packaging defects of chili sauce products on the machine is carried out within 7 days. The analysis method uses Pareto diagrams, pie charts, and control charts. The results obtained are the highest plastic packaging defects in the chili sauce production process, the highest on machine number 1 is 22% with the number of packaging defects being 170 pcs.
Keywords: *Chili Sauce; Defect Packaging; Pareto Chart*

INTRODUCTION

Packaging is one of the important elements of a product which is the outermost part to wrap and protect the product from shocks, collisions, and others. Aside from being a wrapper, packaging can also provide information on a product that is in it, such as expiration, production code, information on nutritional value, and composition, and show identity or characteristics that will be known by consumers. In general, food packaging is a material used to contain and/or wrap food, both in direct and indirect contact with food (Juwita, 2012). The role of packaging is very important for food product ingredients. The role of packaging includes maintaining materials in a clean and hygienic condition, reducing wasted material during distribution, maintaining the nutrition of packaged products, as a measuring tool, information media, and at the same time as a means of promotion (Noviadji, 2015).

Product packaging affects consumer decisions when they want to buy a product. This is because of the first impression that consumers get after seeing the shape of the product packaging being sold. The quality of product packaging is certainly an important concern for every food or beverage industry player. If the quality of the packaging is good, consumers will be very interested in buying it, but if the quality of the packaging is low, and there are damage or defects, then consumers will not be interested in buying it and will even complain and judge that the quality of the product is low. This will certainly be very detrimental to the company and be an evaluation in the future.

The packaging process carried out by Factory X for chili sauce products uses primary packaging and secondary packaging. According to (Noviadji, 2015), primary packaging is packaging that is in direct contact with the product it is wrapped in, secondary packaging is packaging that is not in direct contact with the product but wraps the product that has been packaged in primary packaging. The primary packaging uses Polyethylene terephthalate (PET) plastic with a pillow/refill packaging model, while the secondary packaging uses cardboard. Plastic packaging with code number 01 and type of PET plastic is a plastic packaging that is transparent, strong, solvent-resistant, gas-tight, water-resistant, and softens at a temperature of 80 degrees Celsius. This type of packaging is usually used for bottles of drinks, cooking oil,

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soy sauce, chili sauce, medicine, and sauces. This type of packaging is not for hot water, it is recommended only for one-time use and not for packaging food with temperatures above 60ºC (Anwar & Gunarsa, 2011).

In the packaging process of each food industry, of course, there are also packaging products that are defective or fail in packaging. According to (Hidayah, 2010), packaging damage is an event that is not desired by the company such as defects, damage, and failures that cause the product to be discarded or reworked. The high percentage of packaging damage can cause losses to the company. Relationship damage or defects also have an impact on product quality. Defective products can occur during the distribution or packaging process during a machine error, so there is a possibility that defective products (torn and others) have the potential to be contaminated by bacteria, outside air, or spores. Thus, it is very important to handle defective products and control them through Quality Control in the packaging process. This can be prevented by carrying out quality control in the packaging process, to minimize failure or defects in packaging and products to their destination with excellent quality.

Quality control and supervision must be carried out from the beginning of the production process to the distribution channel. The purpose of supervision and quality control is to increase consumer confidence, increase product safety assurance, prevent the number of damaged products and prevent wasted costs due to losses that can be caused (Junais et al., 2018). One method that can identify and identify the most significant factors of product packaging damage/defects is to use a Pareto diagram. According to (Gaspersz, 2006), the Pareto chart or Pareto diagram is defined as one of the quality control tools (Quality Control 7 Tools) that helps us analyze based on the category and the implications of the data pattern (cause to effect) on the overall effect or problem. It also helps us to focus our efforts on the largest data contribution (20/80).

Based on the description of the problem, the purpose of this study is to determine the process that produces the most plastic packaging defects per machine in chili sauce products.

MATERIALS AND METHOD

This research was conducted at Factory X, West Java. The data collection used in this research includes observation and interviews. The process of observing defects in the plastic packaging of chili sauce products for each machine is carried out within 7 days. The research variable used in this study was the type of plastic packaging defect found in chili sauce products in the 600-gram pillow/refill packaging. For example, the packaging is only cut in half, the package is not filled with sauce and the package is not cut.

RESULT AND DISCUSSION

Plastic Packaging Defects in Each Machine

Polyethylene terephthalate (PET) plastic as primary packaging for chili sauce products in Factory X has a major contribution in protecting the core of chili sauce products from damage or defects. The nature of PET-type plastic is transparent, clean, clear, and resistant to organic solvents such as organic acids from fruits so that it can be used to package fruit juice drinks and is strong and not easily torn. In warm or hot conditions, the polymer layer will melt and release carcinogens which in the long term can cause cancer (Mediastika, 2013). The advantage of using PET-type plastic is that this type of plastic is more resistant to higher heating when compared to other types of plastic. In addition, this type of PET plastic has convenience when printed because it is reactive to ink. However, this type of plastic has the disadvantage that it is not resistant to contact with strong acids, phenols, and benzyl alcohol (Coles et al., 2009).

Packaging for food certainly has requirements as food packaging materials, especially as packaging that is in direct contact with food products. One of the main requirements that must be met is referring to the Indonesian National Standard (SNI) on food packaging. The National Standardization Agency (BSN) has set one of them SNI 19-2946-1992 regarding the quality requirements of plastic bottles for medicine, food, and cosmetic containers with the scope of the types of tests, namely physical, chemical, and organoleptic tests (Botol Plastik Wadah Obat, Makanan, dan Kosmetik (SNI 19-2946-1992), 1992).

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The properties and characteristics of PET plastic according to BPOM 2014 concerning Guidelines for Selection of Types of Food Packaging include specific gravity of 1.4 g/cm^3, a thickness of 12 and 25 microns, best mechanical shock resistance, glossy and transparent, good gas barrier. but it is a poor moisture barrier, has the best heat stability, is easy to metalize, is easy to laminate, and cannot be used as a sealing layer. Then, the printing characteristics of plain PET films have a surface strength between 42-46 dyne/cm and the surface strength is usually increased to 45-58 dyne/cm to increase the adhesion to the ink (Badan Pengawas Obat dan Makanan RI, 2014).

The selection of the type and thickness of the primary packaging will affect the external environment. In addition, indicators in the form of water vapor, gas, and light also need to be considered. The water vapor resistance of packaging material can be seen in the value of the Water Vapor Transmission Rate (WVTR), the WVTR value is the rate at which water vapor penetrates the layer of packaging material at a certain temperature and humidity in a steady state. While the gas resistance of packaging material can be seen in the Oxygen Transmission Rate (OTR) value. The OTR value is the rate of oxygen gas penetrating the packaging material layer at a certain temperature and humidity at a steady state as well. Low WVTR and OTR values will prevent water vapor and oxygen from entering the packaging, s and packaged foodstuffs will have a higher shelf life (Sampurno, 2008).

PET plastic, as the primary packaging for chili sauce products at Factory X, has its quality standards in terms of physical or visual characteristics: soft plastic, not too stiff, strong, transparent, water-resistant, clean, and without defects. The PET plastic packaging quality standard applied by Factory X is only by literature references, but not by SNI 19-2946-1992 regarding Quality Requirements for Plastic Bottles for Medicine, Food, and Cosmetic Containers and BPOM RI 2014 concerning Guidelines for Selection of Types of Food Packaging that have other requirements, both physically and chemically, so that the quality of products packaged by meeting the quality requirements of plastic packaging can be maintained from harmful substances that can migrate into the packaged food and prevent damage or defects in product packaging.

In this study, Pareto diagram analysis was used to identify and identify the most significant causal factors of damage or defects in the plastic packaging of chili sauce for each machine. By knowing the dominant causes, it will be able to set priorities for improvement. Improvements to these dominant causative factors will have a greater influence than solving meaningless causes (Devani & Marwiji, 2014). The data was obtained from the observation of plastic packaging defects for 7 days. The data from the observation of plastic packaging defects in chili sauce products for each machine are as follows:

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Table I. Observation results of plastic packaging defects in chili sauce products in each machine

Machine	Defects (pcs)							Total Defects
	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	
Machine 1	31	20	17	34	23	20	25	170
Machine 2	25	11	13	20	17	19	23	128
Machine 3	17	8	15	25	14	23	17	119
Machine 4	15	10	12	21	15	17	18	108
Machine 5	21	14	19	27	17	29	13	140
Machine 6	11	9	15	23	13	19	10	100
Total	120	72	91	150	99	127	106	765
Total packaging passes	33120	28512	40320	41760	25344	31104	40800	

Table II. Percentage of Defects of Plastic Packaging Each Machine

Defect/Machine	Total	Percentage	Cumulative Percentage
Machine 1	170	22%	22%
Machine 5	140	18%	41%
Machine 2	128	17%	57%
Machine 3	119	16%	73%
Machine 4	108	14%	87%
Machine 6	100	13%	100%
	765	100%	

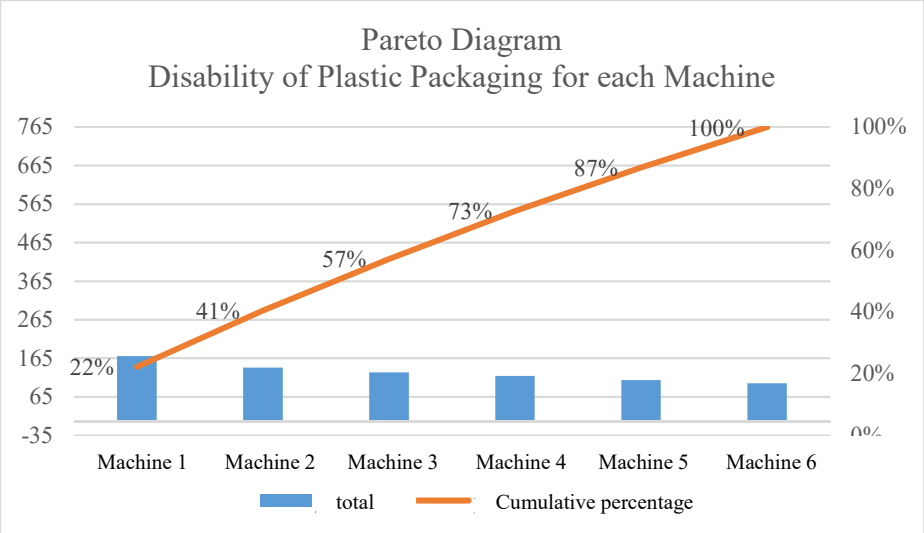

Figure 1. Pareto Diagram of Plastic Packaging Defects of Each Machine

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Based on Table I shows that the level of defects in plastic packaging for each machine within 7 days, in order from highest to lowest, is machine number 1 with a percentage of 22% and the number of packaging defects is 170 pcs. Machine 5 with a percentage of 18% and the number of defective packaging is 140 pcs. Machine 2 with a percentage of 17% and the number of defective packaging is 128 pcs. Machine 3 with a percentage of 16% and the number of defective packaging is 119 pcs. Machine 4 with a percentage of 14% and the number of defective packaging is 108 pcs. Machine 6 with a percentage of 13% and the number of defective packaging is 100 pcs. Therefore, in the plastic packaging process, it is necessary to carry out an in-depth inspection and control of each machine and it is necessary to increase the accuracy of the workers in the packaging process, to reduce the level of defects in the plastic packaging of each machine in chili sauce products.

Supervision of quality standards on plastic packaging is certainly very important to apply, as is the case with food ingredients themselves. This greatly affects the quality of food or products packaged in it. In the process of controlling and supervising refilled plastic packaging, the quality control (QC) will first check the automatic packaging machine starting from the funnel to insert the plastic roll, packaging temperature, sealer for pressing, and others so that the machine can function properly. Quality control by QC is carried out by checking the PET-type plastic packaging material with the quality standards that have been applied by the company and when weighing the finished plastic packaging sauce, the net weight of the sauce should not be below 600 grams and should not exceed 620 grams. Then, the secondary packaging process for chili sauce products at Factory X uses secondary packaging in the form of cardboard. The packaging process is done manually. Each cardboard contains 24 pcs of plastic pillow packaging/chili sauce refill. Secondary packaging serves to protect the primary packaging, simplifying the process of storing and transporting products. Quality control by quality control when the product has been packaged with cardboard is carried out by recording the results that have been obtained during the hourly time and checking the placement of the cardboard storage layout where the cardboard must be stored on a pallet as a load base to withstand heavy loads of goods. Then, the control process is only done visually checking by looking at the physical shape of the cardboard whether there are defects or damage to the cardboard for an indefinite time. If there is a cardboard that is damaged in the form of the physical condition of the cardboard or the primary packaged chili sauce product, the cardboard is replaced and the new chili sauce product is refilled.

The distribution process requires special attention such as the selection of actions to pay attention to each process so that it is well integrated (Pakudu et al., 2014), discusses efforts to overcome failures in the distribution process and provide the best solution so that failures in the process can be minimized. According to (Kusuma, 2015), the distribution process is run regularly and in an orderly manner, and the distribution flow from the place of origin to the destination will run well. If the distribution process goes well, it will reduce defective products and this affects the quality assurance of the product. Based on the results of observations, the actions taken by Factory X when a product is defective or damaged during the distribution process are to return the defective product or return it to the factory. Usually, defective or damaged products are known after making a distribution trip and arriving at the storage warehouse. Then, the warehouse employee contacted and confirmed to the office that there were defective or damaged products and then a return or return process was carried out.

In this study, pie chart analysis was used to present data that explained the number of defects in the plastic packaging of chili sauce products for each machine at Factory X within 7 days in the form of a percentage. Based on the results, machine number 1 produced the highest defect rate of 22%, machine number 2 was 17%, machine number 3 was 16%, machine number 4 was 14%, machine number 5 was 18% and machine number 6 was 13%. The percentage of plastic packaging defects by machine can be seen in the pie chart below:

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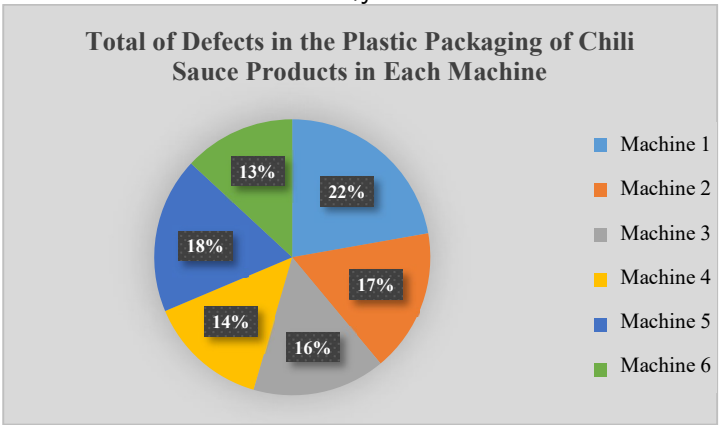

Figure 2. Total of Defects in the Plastic Packaging of Chili Sauce Products in Each Machine

In this study, control chart analysis was used to determine whether the defects in the plastic packaging of chili sauce products on each machine at Factory X within 7 days of observation were under quality control, with parameters of control limits, upper control limits, and lower control limits. The results of the analysis of the control chart for defects in the plastic packaging of chili sauce products for each machine are as follows:

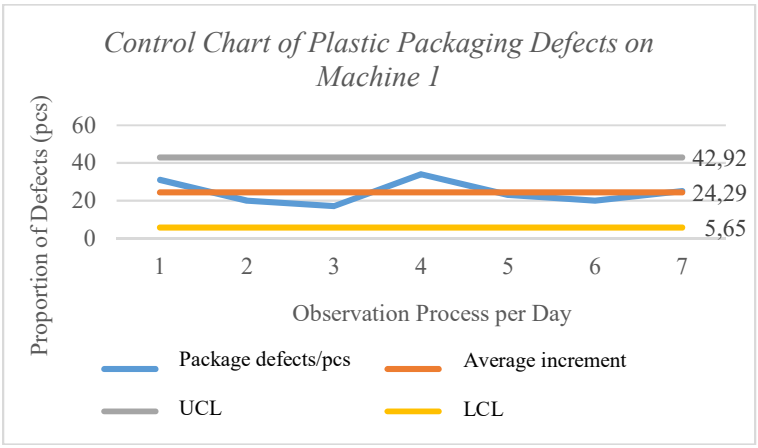

Figure 3. Control Chart of Plastic Packaging Defects on Machine 1

Based on Figure 3, shows the highest number of defects in the plastic packaging of chili sauce products with machine 1, which is 34 pcs on the 4th day. From the control chart, it can be seen that the condition of the plastic packaging defects is still within normal limits or quality control for 7 days, which means that the defects in the plastic packaging of chili sauce products are still well controlled. This is because the number of defects in plastic packaging does not cross the upper control line, which is 42.92, and the lower control line, which is 5.65.

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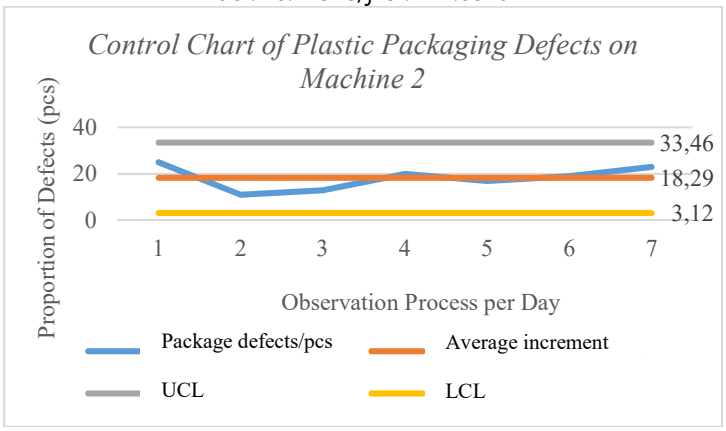

Figure 4. Control Chart of Plastic Packaging Defects on Machine 2

Based on Figure 4, shows the highest number of defects in the plastic packaging of chili sauce products with machine 2, which is 25 pcs on the 1st day. From the control chart, it can be seen that the condition of the plastic packaging defects is still within normal limits or quality control for 7 days, which means that the defects in the plastic packaging of chili sauce products are still well controlled. This is because the number of defects in plastic packaging does not cross the upper control line, which is 33.46, and the lower control line, which is 3.12.

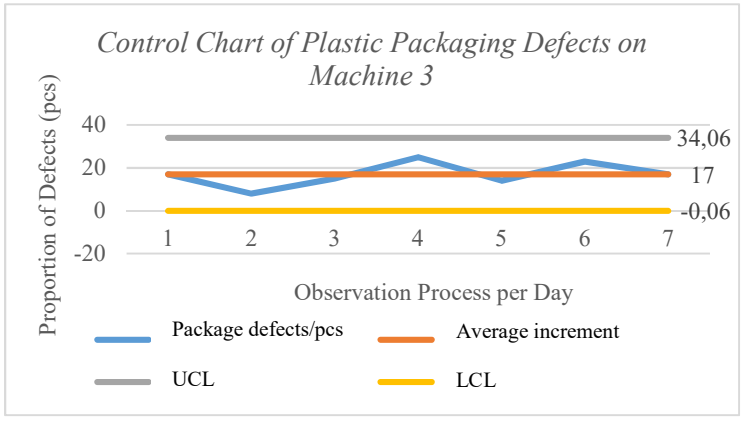

Figure 5. Control Chart of Plastic Packaging Defects on Machine 3

Based on Figure 5, shows the highest number of defects in the plastic packaging of chili sauce products with machine 3, which is 25 pcs on the 4th day. From the control chart, it can be seen that the condition of the plastic packaging defects is still within normal limits or quality control for 7 days, which means that the defects in the plastic packaging of chili sauce products are still well controlled. This is because the number of defects in plastic packaging does not cross the upper control line, which is 34.06, and the lower control line, which is -0.06.

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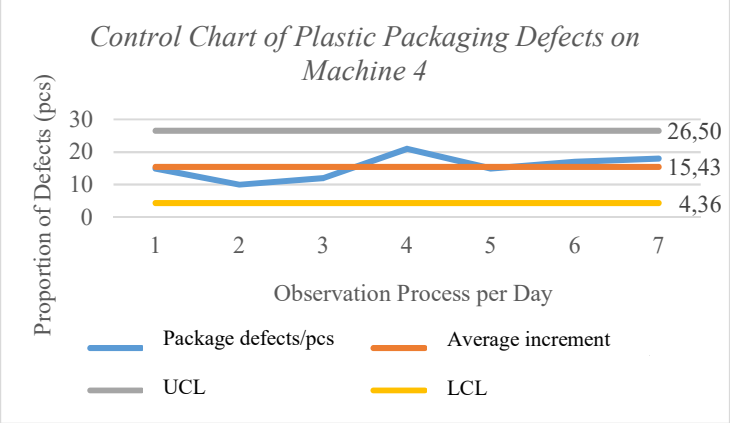

Figure 6. Control Chart of Plastic Packaging Defects on a Machine 4

Based on Figure 6, shows the highest number of defects in the plastic packaging of chili sauce products with machine 4, which is 21 pcs on the 4th day. From the control chart, it can be seen that the condition of the plastic packaging defects is still within normal limits or quality control for 7 days, which means that the defects in the plastic packaging of chili sauce products are still well controlled. This is because the number of defects in plastic packaging does not cross the upper control line, which is 26.50, and the lower control line, which is 4.36.

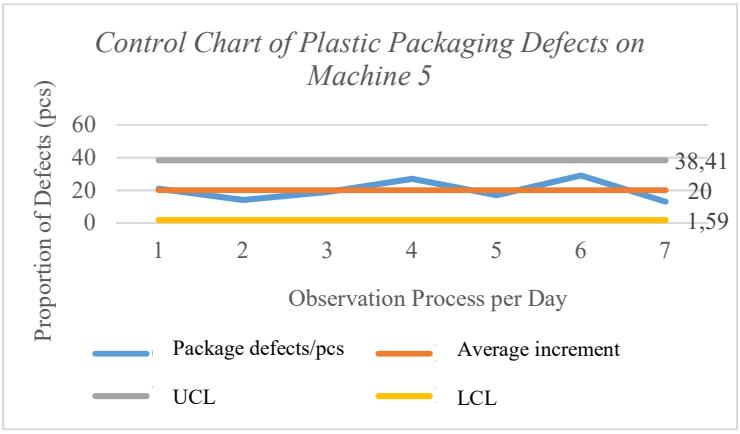

Figure 7. Control Chart of Plastic Packaging Defects on a Machine 5

Based on Figure 7, shows the highest number of defects in the plastic packaging of chili sauce products with machine 5, which is 29 pcs on the 6th day. From the control chart, it can be seen that the condition of the plastic packaging defects is still within normal limits or quality control for 7 days, which means that the defects in the plastic packaging of chili sauce products are still well controlled. This is because the number of defects in plastic packaging does not cross the upper control line of 38.41 and the lower control line of 1.59.

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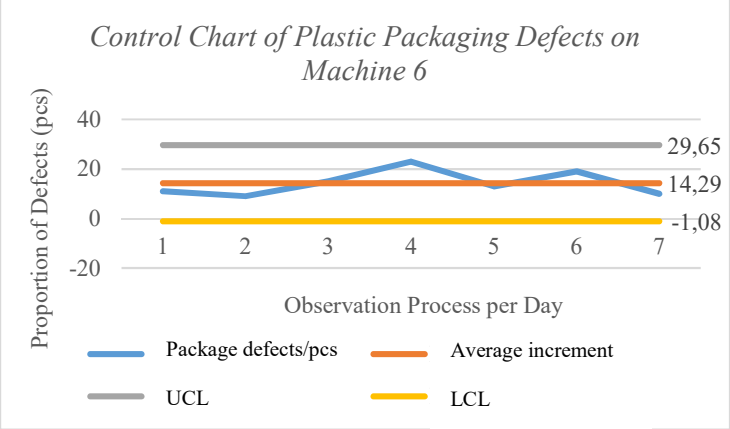

Figure 8. Control Chart of Plastic Packaging Defects on a Machine 6

Based on Figure 8, shows the highest number of defects in the plastic packaging of chili sauce products with machine 6, which is 23 pcs on the 4th day. From the control chart, it can be seen that the condition of the plastic packaging defects is still within normal limits or quality control for 7 days, which means that the defects in the plastic packaging of chili sauce products are still well controlled. This is because the number of defects in plastic packaging does not cross the upper control line, which is 29.65, and the lower control line, which is -1.08.

Overall, the control chart analysis of the defects in the plastic packaging of chili sauce products for each machine in Factory X is still under control because the value of the proportion of defects (pcs) is between the upper control line and the lower control line. Therefore, to prevent and minimize more defects in plastic packaging and not exceed the upper and lower thresholds, it is necessary to improve the packaging process, both in repairing machines to carry out regular maintenance, increasing the accuracy of workers, facilities, and infrastructure, quality of plastic materials and quality of human resources.

CONCLUSION

Based on the research and analysis results that have been carried out, it can be concluded that the machine that produces the highest plastic packaging defects is machine number 1 by 22% with the number of packaging defects per pcs being 170 pcs within 7 days.

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