Ranah Research:
Journal of Multidisciplinary Research and Development
082170743613 ranahresearch@gmail.com https://jurnal.ranahresearch.com
E-ISSN: 2655-0865
DOI: https://doi.org/10.38035/rrj.v7i1

Reducing Sachet Noodle Defects by Applying the Seven Tools and the FMEA Method

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Abstract: PT. ICBP is a company that produces the noodle's sachet on a large scale for domestic and international markets. The sachet's defect of the Regular Special Fried Noodle for the Saudi Arabia market from January up to December 2023 is 2.39%, which is above the company's standard limit. The aim of this research is to determine the types of defects, and to find out the factors that caused them and find out the solutions to minimize the number of defects. Analysis using the seven tools identified that the most dominant defect is swallen laminate, with a percentage of 51% of total defects. By using the Failure Mode and Effect Analysis (FMEA) method, the highest RPN value was obtained at 280 for the machine factor. The recommended solution is to clean up the die lip thoroughly to ensure the condition of the die lip remains clean, to recalculate the need for a Preventive Maintenance schedule and calibration of the die lips based on machine age and machine usage working hours, and at the same time provide SOP and scheduled training for employees to make sure they know how to do the job.

Keyword: Sachet, Defect, the Seven Tools, the FMEA Method, the Risk Priority Number.

INTRODUCTION

The rapid development of technology has helped encourage the manufacturing industry in Indonesia, including packaging industry. Data from the Indonesian Packaging Federation (2020) states that the performance of the packaging industry is projected to grow in the range of 6 percent in 2020 from the 2019 with a realization value of IDR 98.8 trillion. Based on the basic material, the packaging in Indonesia, generally, the 44% are flexible packaging, the 14% are rigid plastic packaging, and the 28% are paperboard packaging (Indonesia, 2020).

PT. Indofood CBP Sukses Makmur Tbk (ICBP) is the manufacturing companies of noodle sachets in Indonesia was founded in 1990. The noodle sachet is marketed for domestic and foreign markets, such as Saudi Arabia, Morocco, and Kenya. The production data in 2023 showed that the level of sachet defects produced exceeded the standard limit set by the company, which was 2.15%. For this reason, it is necessary to carry out research to identify the types of defects, the causes of defects in order to reduce or even eliminate the percentage of the defects sachet.

METHOD

Data for this study were gathered by documentation studies, direct observations, and direct interviews conducted during field research in PT. ICBP. This research focuses on exporting noodle sachets, the Special Fried Noodle - Saudi Arabia variant for the period January - December 2023. Production data shows that the average percentage of sachet's defects is 2.39% per month, which exceeds the company's standard requirements (2.15%). The production data is processed using the Seven Tools method, as follows:

1. The Checksheet makes inspection easier by providing information on production numbers, types of problems, and observation hours (Ginting & Wibowo, 2020; Neyestani, 2017).

Table 1. The Check Sheet Data of the Sachets Defect on January-December 2023

Production Period (Month)	Total Production (*Roll*)	Finished Product (*Roll*)	Type of defect				Defect Product (*Roll*)	Percentage of Defect (%)
			Swallen Laminate (*Roll*)	Unneat Roll (*Roll*)	Uncut Trim Edge (Roll)	Non-standard Weight (*Roll*)		
Jan-23	5.230	5.094	63	17	45	11	136	2,67
Feb-23	4.654	4.547	49	23	27	8	107	2,35
Mar-23	2.324	2.268	32	9	13	2	56	2,47
Apr-23	2.179	2.127	28	8	11	5	52	2,44
May-23	2.041	1.994	21	10	12	4	47	2,36
Jun-23	4.512	4.410	59	12	22	9	102	2,31
Jul-23	2.244	2.192	27	7	13	5	52	2,37
Aug-23	2.116	2.066	26	3	17	4	50	2,42
Sep-23	2.838	2.774	35	10	12	7	64	2,31
Oct-23	2.596	2.536	31	6	17	6	60	2,37
Nov-23	3.506	3.423	40	13	23	7	83	2,42
Dec-23	5.618	5.496	65	14	33	10	122	2,22
Total	**39.858**	**38.927**	**476**	**132**	**245**	**78**	**931**	**2,39**

Resource: PT. ICBP

2. The Pareto Chart could be utilized to determine the essential few contributing elements that must be preserved in order to maintain the intended result (Juran, 1999). By getting maximum results or select the main problems through a simple approach by sorting data from left to right according to the highest to lowest ranking sequence depicted in the form of a histogram. Figure 1 shows the four types of export noodle sachet' defects, namely: Swollen laminate defects with 51.1%, followed by uncut trim edge defects at 26.3%, unneat rolls at 14.2%, and non-standard weight at 8.4%. It can be seen that the swollen laminate has the highest defect, so it becomes the focus of the analysis that will be carried out.

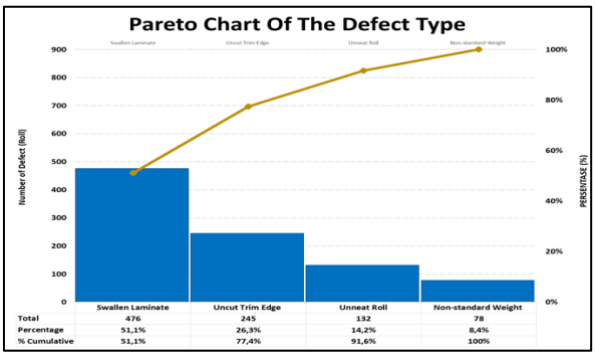

Figure 1. The Pareto chart of the Sachet Defects on the January-December 2023

Source: Data processing

3. The Control Chart is a graphic method used to analyze, evaluate, and detect whether a process/object is in a normal controlled condition or not, so that it can solve the problems and to produce the corrective and the preventive actions that can be implemented immediately (Juran, 1998).

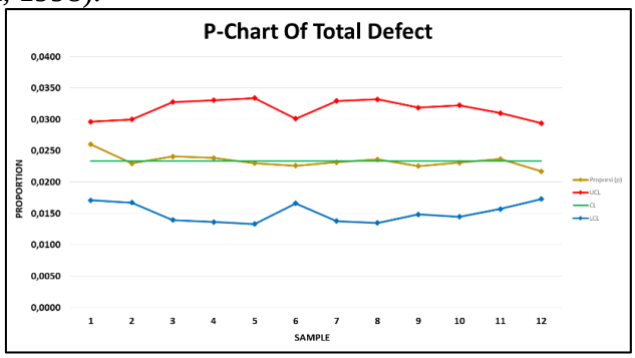

Figure 2. The P-Chart of Total Sachet Defect on the January-December 2023

Source: Data processing

Figure 2 shows the average proportion of sachet' defects in export noodle sachets for the Regular Special Fried Noodles - Saudi Arabia variant for the period of January - December 2023, which is 0.0234. The proportion of sachet' defects during the 12 month period is in the controlled category, because it is still within the control limits of the UCL and LCL values.

4. The fishbone diagram is a method for identifying a problem's underlying cause from affecting elements (Juran, 1999). Figure 3, shows the causes of swollen laminate defects when analyzing the man, the material, the method, the machine, and the measurement factors.

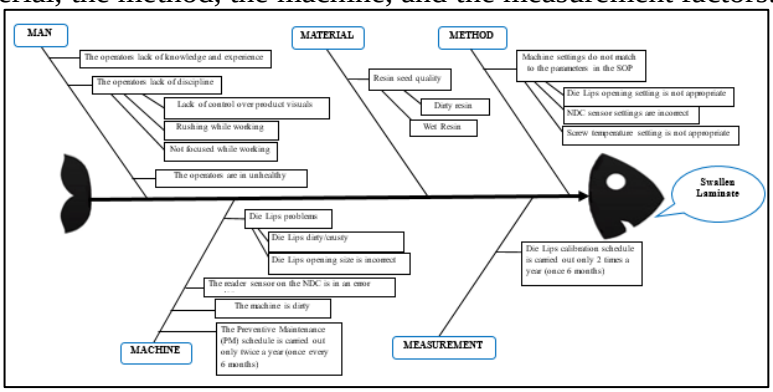

Figure 3. Fishbone Diagram of Product Defect on January-December 2024

Source: Data processing

RESULT AND DISCUSSION

From the analysis using the fishbone diagram, the researcher then compiled a questionnaire to obtain the Critical to Quality (CTQ) of each factor that causes defects. Respondents to the questionnaire are parties who are considered to understand the context, namely production operators, the Production Section Head, the Production Supervisor, the Production QC, and the QC Supervisor. The CTQ results show that there are 4 factors causing

swollen laminate defects that have the highest scores, namely: the Die Lips problems with a score of 20, the Preventive Maintenance (PM) schedule is carried out only 2 times a year (once every 6 months) with a score of 19, the Die calibration schedule Lips were carried out only twice a year (once every 6 months) with a score of 18, and the operator was less disciplined with a score of 17.

Analysis using the FMEA method for the 4 factors with the highest CTQ scores shown in Table 2. The RPN value of potential failures in the process of production export noodle sachet for the Regular Special Fried Noodle - Saudi Arabia Variant as follows:

1. The highest RPN value of 280 indicates that the Die Lips are dirty or crusty from production waste. This condition is caused by the Die Lips not being cleaned properly when the production process start. So the melted resin from production is still left in the Die Lips area.
2. The second rank with a RPN 245 relates to Preventive Maintenance (PM) schedule that is carried out only twice a year (once every 6 months). Preventive Maintenance (PM) is a maintenance activity that is carried out regularly to prevent potential problems with machines, equipment, or other company assets (Bangun, et al. 2022). Therefore, it is important to carry out PM routinely and regularly.
3. The third rank with a RPN 245 corresponds to the Die Lips calibration schedule that is carried out only twice a year (once every 6 months). Calibration is an activity carried out to maintain the condition of equipment or accurate measurement and production results so that the results obtained are in accordance with established standards.
4. The fourth rank with a RPN 245 relates to the operator capabilities of those lack visual control of the product. An operator is a person who plays an important role in operating the machine during the production process. Therefore, operators need to carry out their work in accordance with existing SOPs to produce quality products.

Table 2. The FMEA Result for Swollen Laminate Defect

FAILURE MODE AND EFFECT ANALYSIS (FMEA FORM)

ITEM	: Swallen Lamination			FMEA NUMBER	: 01
PRODUCT NAME	: Special Fried Noodles - Saudi Arabia	PROCESS RESPONBILITY	: Supervisor of Production	PAGE	: 1 of 1
CORE TEAM	: Production, Quality Control, Technician	KEY DATE	: January 2024	PREPARED BY	: Andri Iriyanto
				FMEA DATE	: January 2024

Item	Potential Failure Modes	Potential Failure Effects	*Severity*	Potential Causes of Mechanism Failure	*Occurrence*	Preventive Control Process	Detection Control Process	*Detection*	RPN	Rekomendation Action	Fulfillment of Achievement Targets
Die Lips are dirty / crusty from production waste	The thickness of the melted resin layer on the film is uneven	The surface of the film roll is wavy	7	Die Lips were not cleaned properly at the start of the production process	8	Clean Die Lips properly at the start of the production process	Check the thickness control screen and control the product visuals	5	280	Dismantle the die to ensure the overall condition of the die lips is clean during the cleaning process (PIC Sec. Head of Production)	Die Lips is in pristine condition
Preventive Maintenance (PM) Schedule is carried out only 2 times a year (once 6 months)	Lamination extrusion machines contribute to many production defects	Lamination extrusion machines often experience problems and produce production defects	7	The PM schedule for lamination extrusion machines is carried out twice a year, namely once every 6 months	7	Preventive Maintenance (PM) of extrusion machines is carried out thoroughly	Ensure that the extrusion machine has been carried out PM correctly	5	245	Recalculate PM requirements based on machine age and machine usage according to working hours (PIC: Production Supervisor and Technician)	New Preventive Maintenance (PM) schedule in accordance with machine condition
Die Lips calibration schedule is carried out only 2 times a year (once 6 months)	The thickness of the melted resin layer on the film is uneven	The surface of the film roll is wavy	7	The Die Lips calibration schedule is carried out twice a year, namely once every 6 months	7	Die Lips calibration is carried out according to standards	Ensure that the Die Lips have been calibrated correctly	5	245	Recalculate Die Lips calibration needs based on machine age and machine usage according to working hours (PIC: Production Supervisor and Technician)	New Die Lips calibration schedule according to machine condition
Operators lack control over product visuals	Film rolls resulting from extrusion lamination often have swollen lamination defects	The surface of the film roll is wavy	7	The operator who works only focuses on setting the thickness of the melted resin layer on the control screen display only	7	Perform visual control on products directly while the production process is running	Check the thickness control screen and control the product visuals	5	245	Providing SOP training to increase awareness of operators to produce quality products (Production Supervisor)	Flat extrusion laminate film rolls

Source: Data processing

Based on the results of the analysis using the FMEA method, the following are proposed improvements that can be made to minimize product defects:

1. Machine Factor: the Die Lips are dirty or crusty with a RPN value of 280. The preventive control process can be carried out by cleaning the die lips properly before starting the production process, while the recommended action is to dismantle the die to ensure the overall cleanliness of the die lips during the cleaning process.
2. Machine Factor: The Preventive Maintenance (PM) schedule is carried out only twice a year (once every 6 months) with a RPN value of 245. The preventive control process can be carried out by implementing Preventive Maintenance (PM) on extrusion machines as a whole. The recommended action is to recalculate the need for Preventive Maintenance (PM) based on machine age and machine usage according to working hours.
3. Measurement factors include the Die Lips calibration schedule, which is carried out only twice a year (once every6 months) with a RPN value of 245. The preventive control process is carried out by calibrating the die lips according to standards. Recommended action is to recalculate the need for Die Lips calibration based on machine age, and machine usage according to working hours.
4. Human Factors (Man): The operators are lack of control over product visuals with an RPN value of 245. The preventive control process is carried out by carrying out visual controls on the product directly while the production process is running. Recommended actions include providing SOP training to increase operator awareness of the need to produce quality products.

CONCLUSION

The most dominant production defect in the process of making export noodle sachet for Regular Special Fried Noodle - Saudi Arabia Variants for the period of January - December 2023 is a swollen laminate defect with a percentage of 51.1% of the total defects. These defects are caused by man, machine, and measurement factors. By using the FMEA (Failure Mode and Effect Analysis) method, the highest RPN value was obtained at 280 for the machine factor, followed by the machine factor and measurement with the same RPN value of 245. Using the FMEA method can help to find the factors that most influence the occurrence of product defects and at the same time provide recommendations for proposed improvements (Bangun et al. 2022; Wu et al, 2021; Suwandi et al, 2020; Mascia, et al., 2020; Amperajaya, 2014).

The recommended solution to minimize the defects that occur is to carry out a complete dismantling of the die lip thoroughly to ensure the condition of the die lip remains clean, recalculate the need for the Preventive Maintenance (PM) schedule and calibration of the die lips based on machine age and machine usage working hours and at the same time provide the SOP and the scheduled training for employees to make sure they know how to do the job well.

Further research can be carried out on other products that have a number of defects that exceed company regulations. By adding cost calculations, it will provide a clearer picture of the magnitude of losses caused by product defects. The use of other quality control methods is also highly recommended to achieve more comprehensive results.

This research certainly has limitations so the results may not be generally applicable to all companies.

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