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DEFECT REDUCTION ANALYSIS TO IMPROVE GLASS BOTTLE PACKAGING PRODUCTS QUALITY USING STATISTICAL PROCESS CONTROL (SPC) AT PT. MULIAGLASS CONTAINER (MGC)

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ABSTRACT

Quality plays an important role in business steps throughout the company, to become stronger and stronger in the world market the company must be able to increase efficiency and client or customer loyalty and product excellence. Problems in the amount of production in production caused by various factors that cause a decrease in quality so that it has an impact on a decrease in profits. To prevent an increase in this defective product, it is necessary to evaluate the most types of defects to determine the cause of the defect so that corrective action is obtained using the statistical process control (SPC) method and with 3 Pareto diagram controllers, control charts and fishbone. This research is to find facts about Defect Reduction Through statistical process control (SPC) for the Quality of Glass Packaging Products of PT. Muliaglass Container (MGC) this helps to know the view in reducing the number of products so that they can determine good product quality targets. The implementation of the results of this study shows a fairly good decrease in production on the basis of improvements from the calculation results, namely before repairs from January to March 2021 total defects are 550,962 pc and after repairs in January to March 2022 total defects are 496,260 pc so a decrease of 10% with a cost of Rp. 711,816,014/year.

INTRODUCTION

Undeniably though competition in today's world market is a matter of great change and a tremendous requirement for sustainable business progress (Sheikh, 2018). Quality plays an important role in the steps of business throughout the company, to become stronger and stronger in the world market the company must be able to expand the efficiency and loyalty of clients or customers and expand the advantages of a product. Quality control is an engineering and management activity that measures the quality of the output (goods and/ or services) (Handes et al., 2013). In this way, the business world continues to seek excellence because of the needs and assumptions of the client or customer (Gejdoš, 2015). So that in the company

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the importance of good quality greatly affects the growth rate of the company itself (Mahtani & Garg, 2018). Moreover, there is an increasing demand for returnable packages from many industrial (Tua et al., 2020). Seeing this, PT. Muliaglass Container (MGC) which is a company engaged in manufacturing, is a glass bottle packaging production company, but in its production there are still problems in the number of defects in production caused by various factors, companies that run the production process to meet consumer demand or customers by dividing working hours into 3 shifts in a day where each shift has 8 hours of working time which is carried out continuously for 7 working days. And in this production process, there are still many defects in the products produced. The number of defects can be seen from the production report table at the Container 1 (C1) and Container 2 (C2) factories. And it can be seen from the number and type of defects that can be seen from the table .

Table 1
Production Defect Reports from January to March 2021

Discription		
Shift	1,2,3	
Job Number	-	
Speed	-	
Quantity Annealing		1.112.000
Quantity Ideal		1.159.056
Efficiency	71,79%	
Forming Lost	47.056	41,14%
Rejected By M-Cal (Side Wall)	13	7,29%
Rejected By Multi (Sealing Surface & Bottom)	37	19,42%
Rejected By M-1	61.168	58,85%
Check Ring	5.215	2,11%
Check Under Ring	10.269	11,12%
Check Shoulder	1.222	0,72%
Check Body	3.763	1,70%
Check Bottom	-	0,00%
Split Finish	17.812	7,53%
Split Bottom	2.682	1,51%
Other Checks	1.230	0,51%
Under Size Bore	113	0,05%
Thinwall	-	0,00%
Mould Number Reader	29.550	37,60%
Visual Defects	9.575	4,38%
Stones	359	0,17%
Blister	589	0,28%
Loading Marks	221	0,10%
Washboard	134	0,08%
Haymark	510	0,24%
Skin Cracks	3.170	1,45%
Dirty Oil	173	0,08%
Bad blank seam/Mould Seam	375	0,16%
Other factors	4.044	1,82%
Rejected By Others Problem	-	38,21%

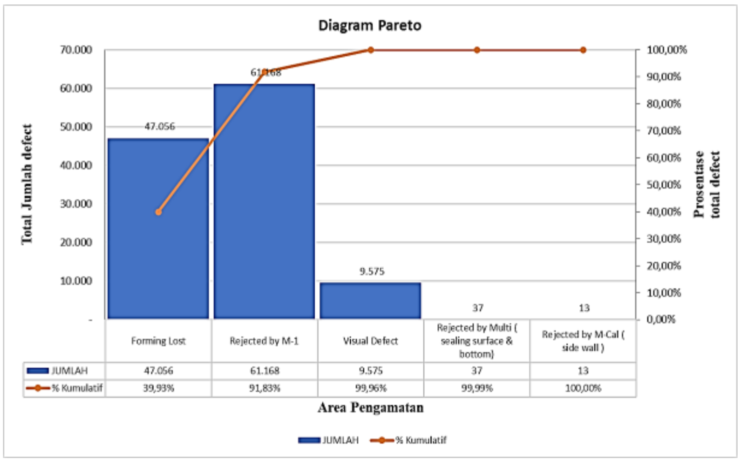


Figure 1. Pareto diagram of defects

From the observations that can be seen from the table above and the Pareto diagram that the number of defects in the production report for a period of 3 (three) months from January, February, and March there is a number of defects in the production of glass bottle packaging which is still quite high, namely in the range of 20 percent and with The average production efficiency level is around 71.79 percent. By looking at this, the problem of defects found in the production of glass bottle packaging at the container factory 1 and 2, which is caused by several factors, makes research to be conducted as for the purpose of this research in order to identify the types of defects that occur as well as to find out the causes of these defects and also obtain solutions to reduce the number of defective products. And below is a table of the dominant defects from several checks on the production process, both by machines and humans visually

Table 2
Actual versus Target dominant defect for three months January – March 2021

No	Dominant Defects	Date	Number of defects			Defects					
			Shift			January (%)		February (%)		March (%)	
			1	1	1	Actual	Target	Actual	Target	Actual	Target
1	Split Finish	01-Jan-21	54	10	11	**0,16 7,12**	**10**	**2,10 42,96**	**10**	**35 50**	**10**
		31-Jan-21									
		01-Feb-21			278						
		28-Feb-21	423		295						
		01-March-21	555	501	76						
		31-March - 21	14.811	421	377						
2	Mould Number Reader	01-Jan-21	714	1.331		**6,96**		**40,86**		**15**	
		31-Jan-21		1.251							
		01-Feb-21			15.352						
		28-Feb-21	1.149		2.852						
		01-March - 21	1.795	1.562							

To prevent this increase in defective products, it is necessary to evaluate the most types of defects to find out the causes of product defects so that corrective actions are obtained using statistical process control (SPC) (Fouad, 2010). Based on the research background that quality improvement is a very important factor for the achievement and development of every company. Thus, it is important to study and analyze in this bottle production process area because there are still many defects found in bottle products and data were obtained in January, February and March 2021. Furthermore, in carrying out the right Statistical Process Control (SPC) strategy in order to complete every difficulty. So the researchers identified the problem formulation into 3 (three), namely:

1. What are the results in minimizing defects in the production of glass bottle packaging?
2. What are the causes of defects and solutions in handling by applying SPC to reduce defects in glass bottle packaging products?
3. How to measure defects and carry out repair and monitoring processes using statistical process control (SPC) methods as well as 3 controllers?

This research is to identify or describe a concept to explain predicting a situation that indicates the type of study to be carried out, in terms of answering the problem formulation are:

1. To find out from efforts to minimize defects in the production of glass bottle packaging.
2. To find out the challenges and solutions to the application of SPC in improving the quality of glass bottle packaging.
3. To find out the efforts of planning, implementing and supervising the SPC method at PT. Muliaglass Container.

The use of SPC in this study can specifically find out the causes and steps to fix it and with this research using the SPC tool can be a final product control tool and to check machine maintenance needs, increase market competence and productivity, using the application of the U-chart control chart.

METHOD

Data analysis in this quantitative study is a result of data processing on problems with defects in glass bottle packaging products in the container 1 and container 2 factories at PT. Muliaglass Container. After the data from the production reports in January, February and March were obtained, the researchers conducted an analysis by grouping them on several variables, presenting data for each variable studied, and performing calculations to answer the problem formulation. Data analysis is also used to test using control charts in order to obtain an overview of the production process. This control chart is used to understand whether a production process is running under controlled conditions or not.

The design of this research is descriptive with a quantitative approach because it allows the collection of data analysis data by describing or describing data from the results of production reports in January, February and March. The quantitative research approach is because the research data is in the form of numbers (Agung et al., 2019). This study is intended to explore facts about Reducing Defects in Processes Through Statistical Process Control (SPC) for Improvement and Supervision of the Quality of Glass Bottle Packaging Products at PT. Muliaglass Container (MGC) is to help determine the view in reducing the number of defects in the product so that it can increase efficiency targets.

The research variables are: an object or product value that has a certain variation determined by the researcher to be studied and drawn conclusions (Agung et al., 2019).

Variables used

1. Dependent variable The independent variable is a variable that is deliberately regulated by the researcher as an action to be tested because as an output variable, the criteria, the consequent variable in this study is the implementation of the findings (Y)
2. The independent variable is a result or impact of the results of the application of the independent variable. The independent variables in this study are the quality and organizational culture (X1 and X2)

Operational Variable

Operational variables are needed to determine the types and indicators of the variables involved in this study (Singh & Singh, 2015). Operational variables aim to determine the scale of measurement on each of these variables, so that hypothesis testing using tools can be carried out correctly. Operational definitions of the variables to be studied are increasing:

1. Quality(X1)

   Quality is to show that a product conforms to certain physical characteristics defined by certain specifications
2. Organizational Culture (X2)

   Encouraging employees to be more innovative and willing to take risks. Because, every member of the organization has a high level of responsibility, is free to work and has many opportunities for initiative within the organization
3. Implementation of findings (Y)

   Implement and realize the plans that have been prepared into a real form. In preparing a plan, the objectives to be achieved are also drawn up.

Table 3
Independent variables X1 = Quality

Variable	Dimension	Indicator	Item Scale
Quality (X_1) Quality is to show that a product conforms to certain physical characteristics defined by certain specifications.	Performance	Product Specific Functions	Product-specific Function Level
		Product performance	Product Performance Level
	Features	innovate or product development	Create novelty in glass bottle packaging products
	Reliability	Durable product	Meets the requirements of glass bottles economically and with reasonable assurance of continuity and quality
	Conformance	According to standard or specification	Every glass bottle packaging product has a predetermined standard or specification
	Durability	Effective product life	Customers clearly want products that are of satisfactory quality in the long term
	Serviceability	Speed, convenience and complaint handling	The product is able to improve good quality compared to the product that is difficult to repair.
	Estethica	Is the product's visual	Shape and color and beauty are

Variable	Dimension	Indicator	Item Scale
		appeal	the basic values of the product
	Perceived Quality	product excellence	Shows the image and reputation of the product

Table 4
Independent Variables X2 = Organizational Culture

Variable Organizational culture (X2)	Dimension	Indicator	Item Scale
Encouraging employees to be more innovative and willing to take risks. Because, every member of the organization has a high level of responsibility, is free to work and has many opportunities for initiative within the organization.	Culture	Putting quality in all aspects of company operations	Eliminate Waste and defects from operations
	Attitude	People, equipment, suppliers, materials and procedures	Identify and understand problems, test ideas to fix problems, and measure results
	Organization	Identify and understand problems, test ideas to fix problems, and measure results	Leadership by example, Training employees to produce a quality product

Table 5
Dependent Variables Y = Implementation of Findings

Variable	Dimension	Indicator	Item Scale
Implementation of Findings (Y) Implement and realize the plans that have been prepared into a real form. In preparing a plan, the objectives to be achieved are also drawn up.	Statistical quality control (SPC)	Assess and control the production process	Managing Quality and Eliminating Specific Causes of Variability in a Process
	Inspection	Quality Control in Supervision and Control	Inspection through visuals and machines and then test the output process get a higher quality product.
	Sustainable	Implement policies and carry out continuous improvement plans	The results of product quality in accordance with the wishes of customers and low cost

Source: results of research data processing, 2021

The sampling technique in this study used a purposive sampling technique. Purposive sampling is a sampling technique that is often used in research. Purposive sampling is sampling carried out in accordance with the required sample requirements. The sampling is done intentionally by taking only certain samples that have certain characteristics, characteristics, criteria, or properties. Thus, the sampling was not done randomly. Purposive sampling is also called judgmental sampling, which is sampling based on the researcher's judgment regarding who is eligible to be used as a sample (Sugiyono, 2019). Research that takes samples using this technique is required to have a good background knowledge in order to obtain samples that are in accordance with certain characteristics, characteristics, criteria, or properties. Not a few researchers often face problems when the sample to be taken uses a random sampling technique. If the researcher faces a problem like this, then the sampling can be done by purposive sampling. With purposive sampling, it is hoped that the sample criteria obtained are truly in accordance with the research to be carried out (Agung et al., 2019).

RESULTS AND DISCUSSION

For the use of statistical tools is an improvement in a production process and product statistical tools can be obtained without large capital costs but the design will require investment in man hours and in this case an understanding of statistical methods and their limitations is needed how understanding of manufacturing processes and products is very important so that statistical tools can be a control and improvement in the process of making glass bottle packaging using information taken from samples to arrive at conclusions about the nature of the product or process being sampled. And in this study, the data analysis that will be discussed is by using static process control with 3 (three) control devices.

All types of glass bottles are made of the same material, but in terms of the manufacturing process, it all depends on the type of glass to be made. Glass is considered as the main material in the beverage product industry, and furthermore every process in the size of glass bottles is very important. Glass bottles are produced by melting sand and blowing a liquid viscous material into the desired shape using a mold and then cooling it. The process may seem simple, but various technologies are used to achieve defect-free glass bottle packaging.

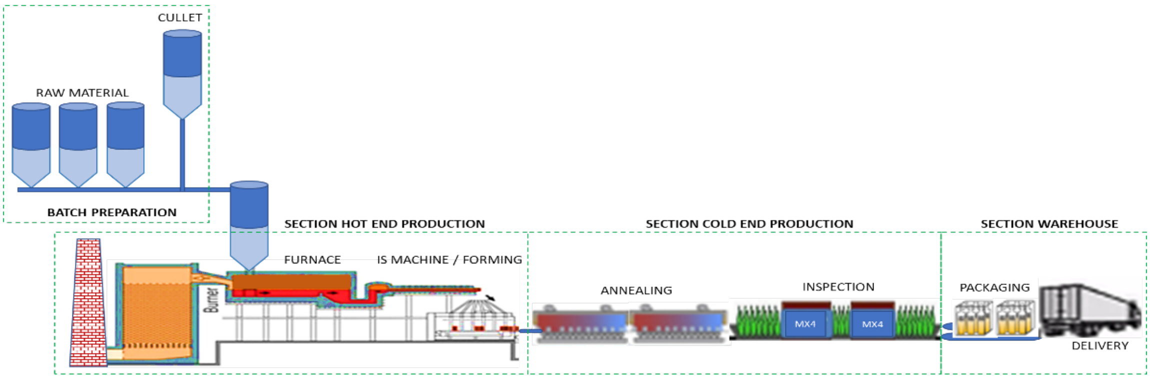


Figure 2. Flow of making glass bottles

The most common way of making glass may look simple, but it combines many advances or technology to provide glass that is free from defects. Glass bottles are produced by melting sand and then blowing a liquid viscous material into the desired shape using a mold and then the finished glass bottle is cooled. The process may seem simple, but various technologies are used to obtain defect-free glass bottles in glass bottle manufacturing plants (Suhartini, 2020). Moreover, from the observations obtained data on the types of defects that occur during the production process of glass bottle packaging. The results of this description analysis can be seen as follows. One of the problems that arise in the production of MGC is the high loss of glass due to loss defects of 47,056 pc (41.14%)

in the Forming area and 61,168 pc (58.85%) in the QC area for 3 months (period January 2021 to March 2021).

Table 6

Data on the number of loss defects in the production of glass bottle packaging

No	Problems	Total	
		Qty	%
1	Forming Lost	47.056	41,14%
2	Rejected by M-Cal (side wall)	13	7,29%
3	Rejected by Multi (sealing surface & bottom)	37	19,42%
4	Rejected by M-1	61.168	58,85%
5	Visual Defect	9.575	4,38%
6	Effisiency	71,79%	

Source: PT. MGC (QC.Dept)

In the table 6, item 1 is the loss in the forming area and items 2,3,4,5 are the loss in the QC area. The data is taken at the beginning and end of the month in 3 shifts.

Histogram

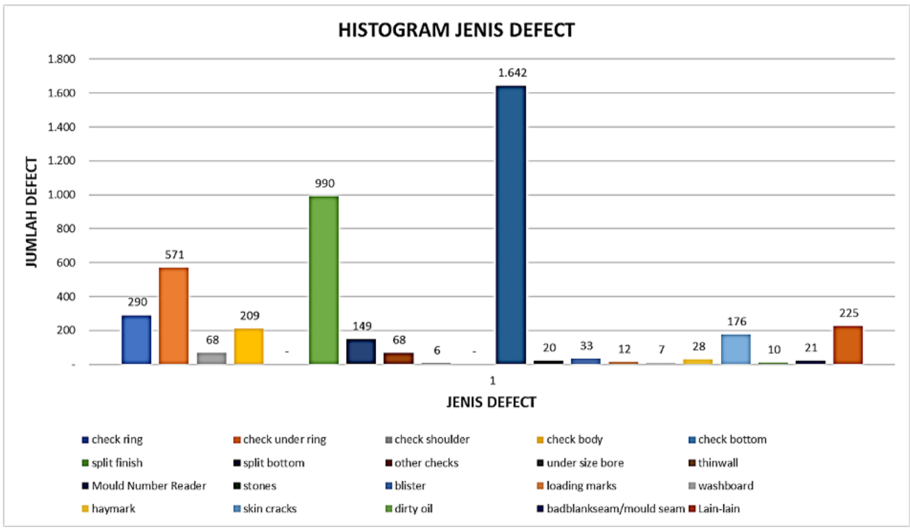


Figure 3. Histogram diagram

From the histogram, it is known that the average total defect is 4,524 pc which occurs in January to March 2021 with a time range at the beginning and end of the month with data taken in 3 shifts with working hours shift 1 hour 7 – 15.00, shift 2 hours 15.00 – 23.00, shift 3 hours 23.00 – 07.00 so that the dominant type of defect can be known.

Control Chart

In this study, a control chart is used to determine whether the resulting product defects are still within the required limits (Yemima et al., 2014). Comparison between the number of defects with all observations, namely each product classified as "accepted" or "rejected" (which is considered the number of defective products).

Table 7

Control chart

No	Discription Shift 1,2,3	Xi	Xi2	X	Std Deviasi	UCL (3s)	LCL (3s)
	Defects type						
1	check ring	289,7222	83938,97	226,1972	411,6789931	1461,234	-1008,84
2	check under ring	570,5	325470,3	226,1972	411,6789931	1461,234	-1008,84
3	check shoulder	67,88889	4608,901	226,1972	411,6789931	1461,234	-1008,84
4	check body	209,0556	43704,23	226,1972	411,6789931	1461,234	-1008,84
5	check bottom	0	0	226,1972	411,6789931	1461,234	-1008,84
6	split finish	989,5556	979220,2	226,1972	411,6789931	1461,234	-1008,84
7	split bottom	149	22201	226,1972	411,6789931	1461,234	-1008,84
8	other checks	68,33333	4669,444	226,1972	411,6789931	1461,234	-1008,84
9	under size bore	6,277778	39,41049	226,1972	411,6789931	1461,234	-1008,84
10	thinwall	0	0	226,1972	411,6789931	1461,234	-1008,84
11	Mould Number Reader	1641,667	2695069	226,1972	411,6789931	1461,234	-1008,84
12	stones	19,94444	397,7809	226,1972	411,6789931	1461,234	-1008,84
13	blister	32,72222	1070,744	226,1972	411,6789931	1461,234	-1008,84
14	loading marks	12,27778	150,7438	226,1972	411,6789931	1461,234	-1008,84
15	washboard	7,444444	55,41975	226,1972	411,6789931	1461,234	-1008,84
16	haymark	28,33333	802,7778	226,1972	411,6789931	1461,234	-1008,84
17	skin cracks	176,1111	31015,12	226,1972	411,6789931	1461,234	-1008,84
18	dirty oil	9,611111	92,37346	226,1972	411,6789931	1461,234	-1008,84
19	badblankseam/mould seam	20,83333	434,0278	226,1972	411,6789931	1461,234	-1008,84
20	Lain-lain	224,6667	50475,11	226,1972	411,6789931	1461,234	-1008,84
		4523,944	4243416				

Standard deviation

$$S = \sqrt{\frac{n \Sigma Xi^2 - (\Sigma Xi)^2}{n(n-1)}}$$

$$S = \sqrt{\frac{20 \times 4,243,416 - (4524)^2}{20(20-1)}} \qquad S = \sqrt{\frac{84.868.320 - 20.466.576}{20(19)}}$$

$$S = \sqrt{\frac{64.401.744}{380}} \qquad S = \sqrt{169.478,27}$$

$$S = 411.68$$

Control Line

$$CL = \bar{X} = \frac{\Sigma Xi}{n} = \frac{4524}{\text{(number of defects)}} = \frac{4524}{20} = 226.20$$

Finding the UCL . value

$$UCL = CL + (3\sigma)$$

$$= 226.2 + \left(3 \times \sqrt{\frac{n \Sigma Xi^2 - (\Sigma Xi)^2}{n(n-1)}}\right)$$

$$= 226.2 + (3 \times 411.68)$$

$$= 226.2 + 1235.04$$

$$UCL = 1461.24$$

Finding the LCL value

$$LCL = CL - \left(3 \times \frac{\sqrt{n \sum Xi^2 - (\sum Xi)^2}}{n\,(n-1)} \right) = 226.2 - (3 \times 411.68)$$

$$= 226.2 - (1235.04)$$

$$LCL = -1008.84$$

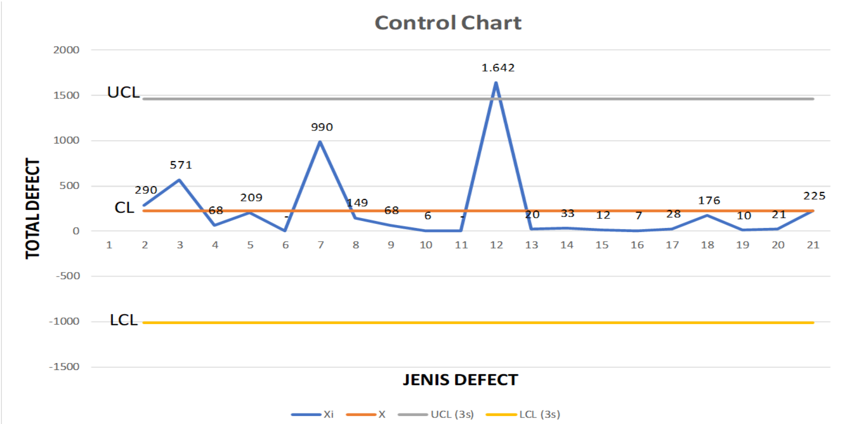


Figure 4 Control chart diagram

From the results of analysis and observations on the control chart, there is a special trend and corrective action is required because there are defects that are beyond the control limits, so corrective action must begin with an investigation in order to obtain the root cause of the defect in the production of glass bottle packaging.

Focus group discussions (FDG)

Table 8
Focus group discussion (FDG) table

No	Influence Factors	PON	JER	BAR	KOD	AGU	Total	Rank
1	Knowledge of the maintenance of work equipment facilities	3	2	4	3	2	14	5
2	Material warehouse building roof	7	7	7	7	7	35	7
3	Raw material machining facilities	7	7	7	7	7	35	7
4	Glass cullet splattered with waste iron	7	7	7	7	7	35	7
5	Rusty and corrosive conveyor	7	7	7	7	7	35	7
6	Drainage of raw material warehouse	2	3	2	3	2	12	4
7	Maulding maintenance	3	4	4	4	3	18	6

The table 8 is followed by 5 members who provide suggestions and the weight of the control and improvement values after which they are added up and given a ranking value to determine the priority of improvement (Gejdoš, 2015).

The weight of each participant's score from 1 to 7 causes of the dominant problem is determined by the NGT formula:

$$NGT = \tfrac{1}{2} N + 1$$
$$= \tfrac{1}{2} \times 7 + 1$$
$$= 3{,}5 + 1$$
$$= 4{,}5\ (5)$$

N = Number of Causing Factors

Based on the results of the NGT test of the 7 dominant causative factors, the 5 most dominant factors were obtained and the dominant factors were

1. The roof of the building Material warehouse
2. Raw material machining facilities
3. Glass cullet mixed with iron waste
4. Conveyor is rusty and corrosive
5. Molding maintenance

Fishbone Diagram

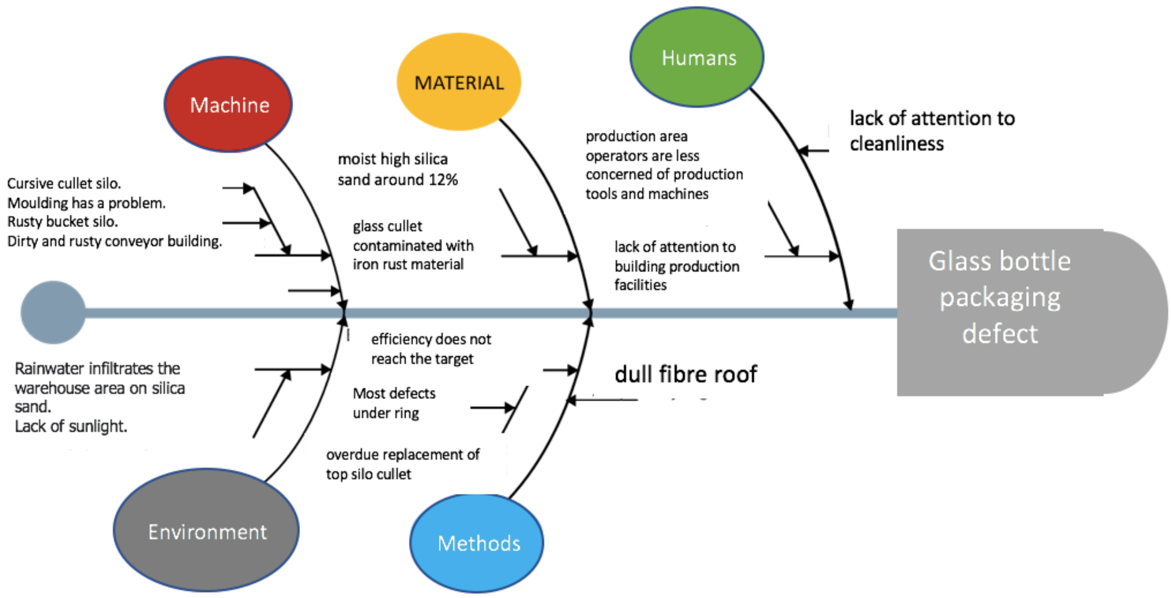


Figure 5. Fishbone Diagram

From this fishbone diagram identify the causes that may arise from a problem and help find ideas for solutions to a problem. And we can see that the machine is the dominant factor in the occurrence of low efficiency and does not reach the target so that it affects the material as the raw material for making glass bottle packaging (Juran & Godfrey, 1999).

Table 9
Suggested corrective actions

Type	Action plan suggestions
Man (operator)	-Must have expertise in identifying the causes of defects before they occur - Using a machine to filter and separate from impurities -Must have a good attitude towards quality improvement. - Able to identify damage quickly and accurately and know how to repair it (providing training for operators). - Doing training.
Machine	- Preventive maintenance to ensure the machine is always in good condition - All parts of the silo and conveyor must be properly maintained. - Frequent machine checks - Inspection of molds for wear (moulding) - Preventive maintenance of storage warehouse buildingg
Material	-Must use raw materials with appropriate quality - The cullet should be cleaned with an appropriate cleaning agent to remove any contamination that could cause bubbles when the cullet material melts. - Avoid material from corrosive contamination from the collection bucket - Check the moisture (moisture content) of the sand material <= 6%

Type	Action plan suggestions
Environment	- Avoid sand material from leaking when it rains - Use natural lighting to reduce moisture in the sand

5W + 2H repair plan table

Table 10
Repair Plan

Problem	Why	What	Where	When	Who	How	How Much
Defect Bottle	High defect on production packaging bottle glass	Evaluation happening defects in the area machine forming	MGC	Sep 20-May 21	Ali	Inevaluation to mold print bottle party engineering	100%
	Moist sand silica among 8% – 12%	Roof fiber as function lighting and experience dull	MGC	Sep 20-May 21	Ali	To do repairon the top silo and building support	100%
	Cullet mixed with excorrosive material steel on closing receptacle silo	Check in output cullet silo	MGC	Sep 20-May 21	Ali	To do repair top silo and to do painting return cover silo	100%
			MGC	Sep 20-May 21	Ali	To do repair on part machine conveyor silos and to do painting return	100%

Managerial implications

Statistical process control (SPC) is the ability to clearly identify the root of the problem and its causal factors so as to minimize defective products and proposed improvements as an effort to reduce defects or defects in glass bottle packaging products (Edossa & Singh, 2016), including:

1. Repair of the cullet silo that causes contamination of the cullet material with iron material due to the corrosiveness of the storage container.
2. Machines and conveyor roofs cause contamination of the cullet material with iron material due to the corrosiveness of the engine and the roof of the building.
3. Repairing the roof of the storage warehouse causing the high moisture content of the sand

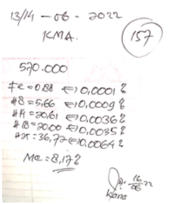
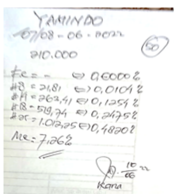
Table 11
Managerial implications

Causative factor	Repair Description	Cost of repairs	Condition Before Repair	Condition After Repair
Silo cullet on the top (cover) of the Keropos silo	Replacement and repair of the top silo repair item replacement of the silo cover support structure and silo cover plate replacement	Rp. 130,734,103	 	  
Conveyor machine and constructio	Repainting and cleaning of the conveyor	Rp.96,244,366		

Causative factor	**Repair Description**	**Cost of repairs**	**Condition Before Repair**	**Condition After Repair**
n machine cover rusting machine	machine area and the conveyor roof building		 	 
Rusty silos and bucket elevator silos	Repainting and cleaning of silo and bucket silo areas	Rp.69,193,606	 	 
Fiber roof that has been dull and zenk that has been porous	Fiber roof and zenk roof replacement	zenk roof Rp.580,481,271 Fiber roof Rp.271,398,640 Total Rp.851,879,911		

Impact of repair

Table 12
Silo, Conveyor, Bucket Repair Results

Impact of repair	**Condition Before Repair**	**Condition After Repair**
Can reduce glass cullet contamination with iron or steel impurities due to damaged containers or silos due to corrosive effects.	The cullet is dirty because there is iron or steel residue that falls into the silo	 Clean cullet because it is no longer contaminated with iron or steel
Can reduce Moist (moisture content) in silica sand	  Before repairing the silica sand moisture content of samples	  After replacing the roof, the

Impact of repair	Condition Before Repair	Condition After Repair
	from several vendors 7.26% - 8.17%	moist sand quickly dropped between 4.52% - 4.74%
Defect reduction in glass bottle packaging products	550, 952 pc	496,260 pc
Saving Cost	Rp. 711,816,014/year	

The implementation of the results of this study shows that the production savings are quite good based on the results of the above calculations, so that the cost savings of Rp. 711,816,014/year. and there is a fairly good decrease in defects from the previous period of January-March 21 with 10% improvement after the January-March 22 period (54,702 pc). This is the impact of good product results so that customer confidence in PT. Muliaglass Container also increased and we can see in the Pareto diagram below.

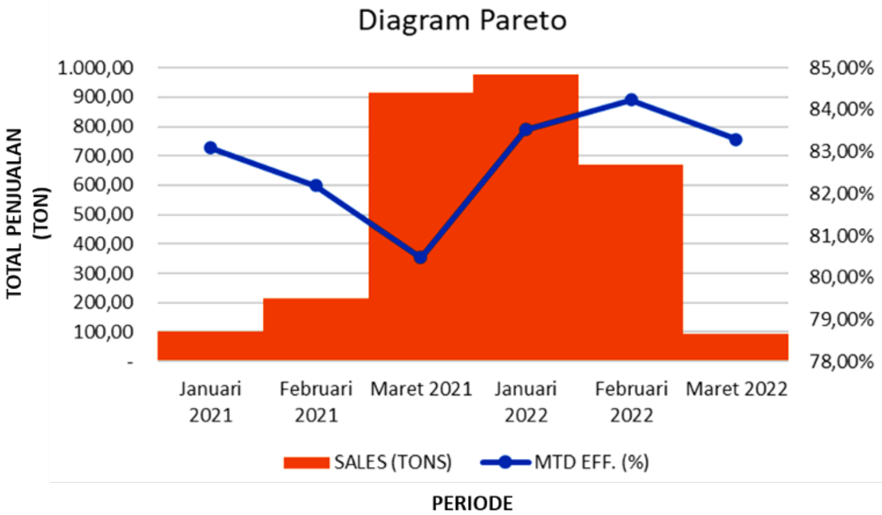


Figure 6. Pareto chart of the trend of increasing sales

If you look at the Pareto chart above, the trend of increasing sales is quite good. This increase is the impact of good product results so that customer satisfaction and trust in PT. Muliaglass Container increased.

CONCLUSION

Based on the research background that quality improvement is a very important factor for the achievement and development of every company. Thus, it becomes important to study and analyze and be able to carry out the right Statistical Process Control (SPC) strategy in order to solve any difficulties.

Efforts have been made to minimize defects in the production of glass bottle packaging by making several improvements to the silo cullet and conveyor as well as repairing the replacement of the roof on the silica sand storage area and this has been approved by the executive director as the main person in charge of operations and succeeded in minimizing the total defect according to target is 10% (Suhartini, 2020).

Handling by using statistical process control (SPC) as control of the production process produces results and finds solutions to be implemented and made improvements so that this is in accordance with the company's vision and mission in a good and sustainable manner so that the production process and results achieve good results so that satisfaction and trust customers towards glass bottle packaging products of PT. Muliaglass Container increased (Kaban, 2016).

The company will continue to carry out the implementation of SPC optimally and sustainably so that in planning the implementation and supervision of the Statistical Process Control (SPC) method at PT. Muliaglass Container (MGC) can always be implemented in order to create a form of good control of the results of changes and maintain the results of these changes for the sustainability and development of the modern glass bottle packaging industry as well as becoming a low-cost producer in Asia-Pacific (Heizer & Render, 2015).

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