Tibuana
Journal of applied Industrial Engineering-University of PGRI AdiBuana
p-ISSN 2622-2027
DOI : https://doi.org/10.36456/tibuana.5.02.5411.69-75 *e*-ISSN 2622-2035

Quality Control Analysis of Fireproof Stone with New Seven Tools Method at PT. Loca Refractories Wira Jatim

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***Abstract*— PT. Loka Refractories WiraJatim is a manufacturing company that produces refractory stones. In carrying out the production process, defective products are often found. In this study, an analysis of the quality control of refractory stone will be carried out using the New Seven Tools method. The purpose of this study was to determine the quality of the refractory stone, the factors that cause disability, and the impact. In addition, suggestions for improvements will be given to improve the quality of the refractory stone produced. The results showed that the most common types of defects were 50% in April 2021, while the types of defects that occurred the least were > 1 type of defects as much as 2% in October 2020. The factors causing the formation of defective products include human errors, old machines, undeveloped work methods, and poor quality raw materials. Improvement activities that can be carried out are improving operator performance, improving machine performance, making work methods, and tightening control of raw materials or QC.**

***Keywords*: Defective Products, Refractory Stone, Quality Control, New Seven Tools**

I. INTRODUCTION

Along with the rapid development of the industry, every company is competing to be able to survive in the market competition. Many industries are trying to maintain and increase the purchasing power of their consumers by increasing their production results in quality, a quantity of production, price, and consumer satisfaction. To achieve customer satisfaction, companies must pay attention to the quality of their products. Providing quality products will lead to trust from consumers to produce a good business relationship. Quality is a factor that greatly determines the success of a product in market competition, apart from related factors such as price and service. A quality product will have an important value in the hearts of consumers so that it becomes one of the benchmarks for the company's success. Quality is not only the responsibility of the production department but is the concern of all parties in the company (Devani, 2021).

PT. Loka Refractories WiraJatim is a company engaged in the production of refractory stone and cement. Especially for refractory stone products that are produced in several forms including blocks, cylinders with a hole in the middle, and half cylinders. Of all the products produced by PT. Loka Refractories WiraJatim, the largest percentage of defects is in refractory stone with the shape of a beam with an average percentage of defects from August 2020 to July 2021 is 2.03%. While the tolerance for defects in each production of refractory stone is 2%.

In this research, the method used is New Seven Tools. New Seven Tools is a tool to map problems in detail to assist decision-making and facilitate work coordination (Handika, 2017). This method is proven to be able to map the causes and effects of product defects which can then be proposed for repair activities. Previous studies that have applied this method are Aziza and Setiaji (2020) who use the new seven tools method to control the quality of furniture products, and Zakariya et al., (2020) who use the new seven tools method to control the quality of bottled drinking water products.

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II. METHODOLOGY

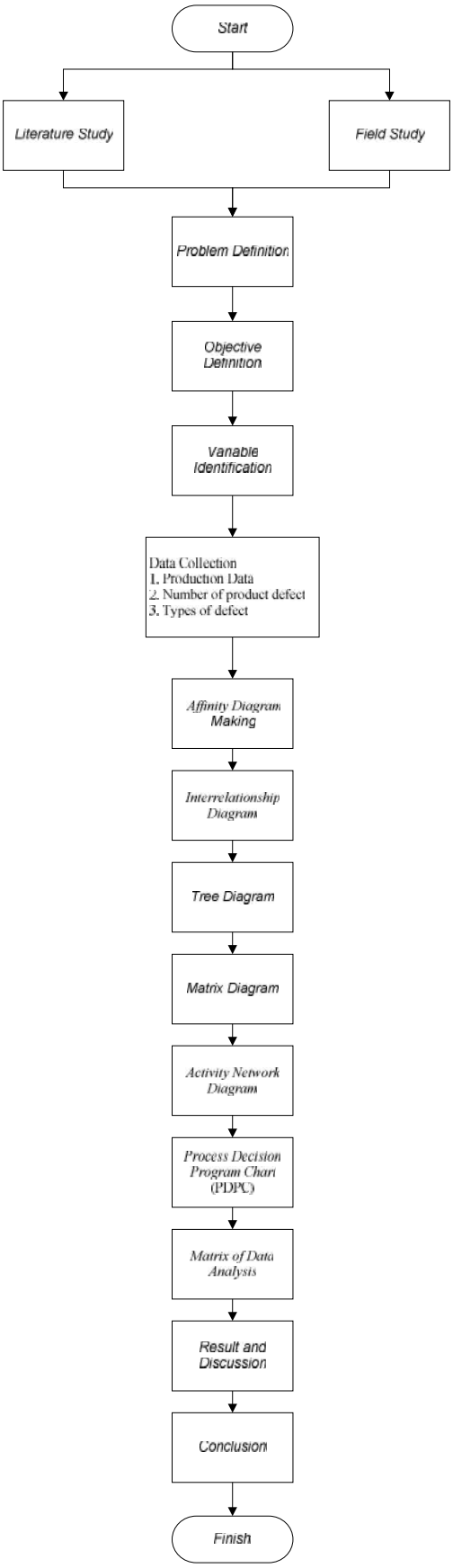

Figure 1. Research Methodology

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III. RESULT AND DISCUSSION

The following are the results obtained using the New Seven Tools method

A. Affinity diagram

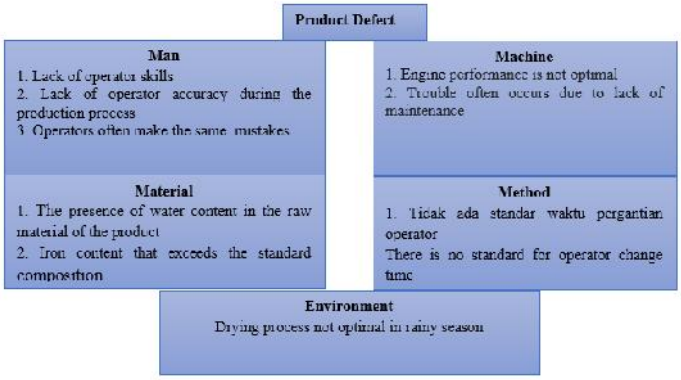

Figure 2. Affinity Diagram

Based on the affinity diagram in Figure 2 above, the factors that cause defects are humans, machines, materials, methods, and the environment. And in each factor has problems that can cause disability. The occurrence of defects is caused by human factors, namely lack of operator skills, operators often make the same mistakes, and lack of operator accuracy during the production process. On the machine factor, namely the age of the machine that is old, problems often occur due to lack of maintenance. On the material factor, namely the presence of water in the raw material of the product, iron content that exceeds the standard composition. In the method factor, namely the printing of certain shapes is still manual, there is no standard time for changing workers. And on environmental factors, namely the rainy season inhibits the dryer process so that it takes time to dry the products.

B. *Interrelationship Diagram*

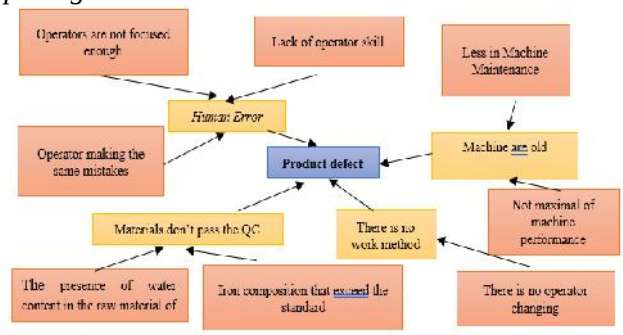

Figure 3. Interrelationship Diagram

Based on the interrelationship diagram in Figure 3 above, shows that the lack of operator skills, lack of operator accuracy during the production process, and operators often making the same mistakes are the result of human error. Then there are often problems due to lack of maintenance, not optimal engine performance is a result of the old age of the engine. Then there is no standard operator change time is the result of no working method. And the presence of water content in the raw material of the product, the iron content that exceeds the standard composition is the result of the raw material not passing QC.

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C. Tree Diagram

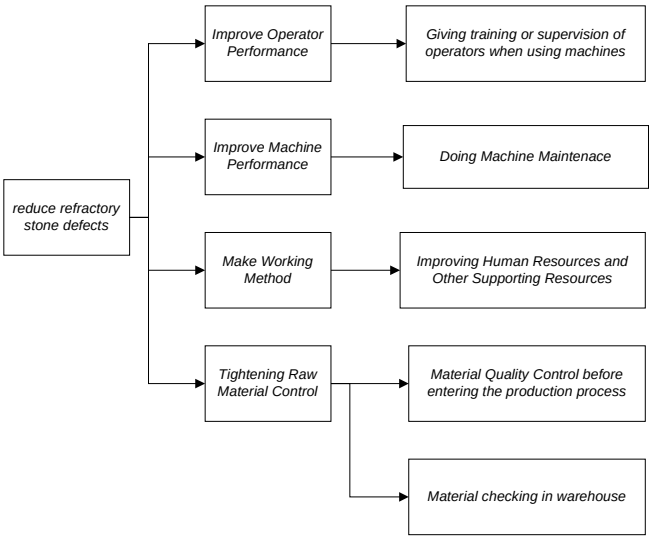

Figure 4. Tree Diagram

Based on the tree diagram or tree diagram above, it can be analyzed that to reduce refractory stone defects, can be minimized by:

1. Improve operator performance by training or supervising operators in using the machine.
2. Improve engine performance by checking and maintaining the engine.
3. Determine work methods by improving human resources and other supporting resources.
4. Tighten Raw Material Control or QC by checking the raw materials to be used, and checking the material in the storage.

D. Matrix Diagram

Human Error Old Machine	■ ●	● ■	▲ ●	▲ ●
There is no working method	▲	●	■	▲
Materials didn't pass QC	▲	●	▲	■
Cause / **Repair Activities** / **Specific Activity**	Improve Operator performance	Improve Machine performance	Making Working method	Tightening Raw Material Control
Giving training or supervision of operators when using machines	■	■	▲	●
Doing Machine Maintenace	■	■	▲	●
Improving Human Resources and Other Supporting Resources	■	■	■	■
Material Quality Control before entering the production process	▲	●	▲	■
Material checking in warehouse	▲	●	▲	■

Figure 5. Matrix Diagram

Based on the matrix diagram in Figure 5 above, the analysis can be carried out below:

1. Causes, repair activities, and specific activities that are closely related are human errors by improving operator performance, namely conducting training or supervision of operators in using machines, checking and maintaining machines, and improving human resources and

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other supporting resources. Then the age of the old machine by increasing the performance of the machine, namely conducting training or supervision of the operator in using the machine, checking and maintaining the machine, and improving human resources and other supporting resources. Then there is no working method by setting a work method, namely improving human resources and other supporting resources. And raw materials do not pass QC by tightening supervision of raw materials or QC, namely improving human resources and other supporting resources, checking raw materials to be used, and checking material storage so that it has a red square symbol.

symbol.

3. Causes, repair activities, and unrelated specific activities, namely human error by increasing machine performance. Then the age of the machine is old by improving operator performance, determining work methods, and tightening supervision of raw materials or QC, namely conducting training or supervision of

2. The causes, repair activities, and related specific activities are human error by establishing work methods and tightening supervision of raw materials or QC, namely conducting training or supervision of operators in using machines, checking and maintaining machines. Then there is no working method for improving operator performance, and tightening control of raw materials or QC, namely checking raw materials to be used, and checking material storage. And the raw materials do not pass QC by improving operator performance and establishing work methods, namely checking the raw materials to be used, and checking material storage so that they have a green triangle

operators in using machines, checking and maintaining machines. Then there is no working method for increasing engine performance. And the raw materials do not pass QC by increasing the machine's performance by checking the raw materials to be used, and checking the storage of materials so that they have a yellow circle symbol.

E. Activity Network Diagram

Table 1
Production Process and Duration

Types of process	Process code	Predecessor	Duration (Hour)
Material inspection	A	-	24
Material sorting	B	A	3
Milling process	C	B	4
Mixing	D	C	3
Making products using die	E	D	2
Dryer	F	E	7
Heating	G	F	36
Packaging	H	G	24

Based on the production information in Table 1 above activity network diagram can be made below in Figure 6.

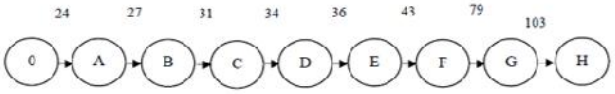

Figure 6. Activity network diagram

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F.*Process Decision Program Chart* (PDPC)

Figure 7 below is PDPC for a porous defect.

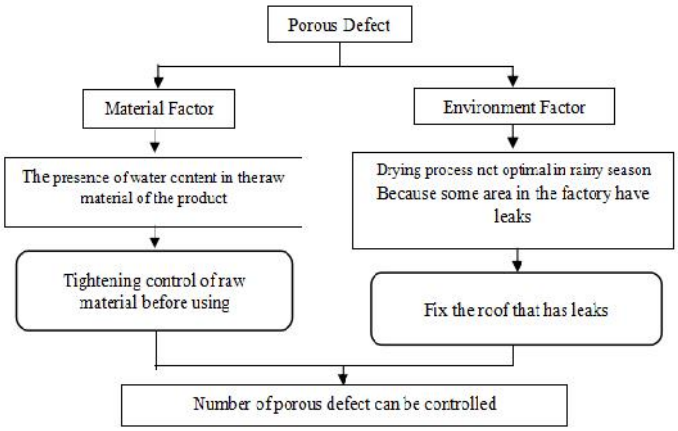

Figure 7. PDPC for Porous defect

G. Matrix Data Analysis
Table 2 below is a matrix data analysis obtained from this research.

Table 1
Production Process and Duration

Primary	***Secondary***	***Importance***	**PT. Loka**
Improve operator performance	Gicing training or supervision when operator is using machine	4	3
Improve machine performance	Doing Maintenance	4	2
Making work method	Improving human resource and other supporting resource	3	2
Tightening raw material control	1. Material quality control before entering the production process	4	3
	2. Material checking in WH	4	3

Explanation: 1 Un done; 2 Rarely; 3 Done; 4 Often

Based on the matrix data analysis, at PT. The WiraJatim Refractories Workshop improves operator performance by training or supervising operators in using the machine. Then to improve engine performance, checking and engine maintenance are still rarely carried out. Then determining work methods by improving human resources and other supporting resources is still rarely done. And tightening raw material supervision or QC by checking the raw materials to be used is still being carried out, and checking material storage is still rarely done.

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IV. CONCLUSION

Based on the graph obtained from data on the number of types of product defects for the period August 2020 to July 2021, it is known that the type of defect that occurs the most is gopil as much as 50% in April 2021, while the type of defect that occurs the least is >1 type of defect as much as 2 % in October 2020.

The factors that cause disability include human error, the old machine age, no working method, and raw materials that do not pass QC. Then the improvement activities that can be carried out are increasing operator performance, improving machine performance, determining work methods, and tightening control of raw materials or QC so that specific activities can be carried out, namely by training or supervising operators in using machines, checking and maintaining machines, improving human resources and other supporting resources, checking raw materials to be used, and checking material storage.

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