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DISABLED ANALYSIS OF CERAMIC PRODUCTS ON THE GLASS PROCESS USING THE SEVEN TOOLS METHOD (CASE STUDY: PT. NJMX SURABAYA

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ABSTRACT

In the production process of quality is very off at PT. NJMX, a company engaged in the manufacture of ceramics where the quality of a good ceramic surface does not have any disability is expected by consumers. This study aims To identify the disability of ceramic products by using the seven tools method on the glaze process, applying the seven tools method as an effective tool to improve productivity and product quality in the process of making ceramic diunit glaze. From the data processing, it can be known that the type of defect that has a high percentage obtained is the pinhole with the total average defect is 57 units, other causes are Dimpel 53 units, 50 glaze cracking, 48 lines and 45 units waves. Of the five types of defects the highest percentage is pinhole defect with a total percentage of 22.60%, while for dimpel 20.90%, cracked glaze 19.66%, 18.93 and 18.93% waves. And obtained the average value of sigma 3.58 with DPMO value of 13.553%.

Keyword*: Seven tools, Disability, Disability analysis*

1. Introduction

firing and double firing with a variety of motifs, designs and sizes. Single firing is a type of ceramic used for walls while double firing is used for floors.

quality control system that is created and implemented. But until now the company has only reached 2250 units for the production of quality A. This research is focused on the Glaze process, the ceramic coating process plays an important role in the production process, because product defects often occur in this process. So that this study aims to identify defects in ceramic products to reduce defects in ceramic products (defects) using the method of repair that is the seven tools method. The use of the seven tools method will provide many benefits for the company. Some previous studies regarding product defect analysis that can be used as references in this study are as follows:

a. Analysis of improving the quality of ceramic products by using the Six Sigma method at CV. Glassmico tile Tulungagung, RonyPrabowo Vol.16 December 2, 2012 quality improvement to eliminate the root causes of failure and improve the quality of the process suppress the failure rate of 3.4 DPMO.
b. Improving the quality of ceramic products with a six sigma approach in the ceramic industry of Dinoyo - Malang, AnnisaKesy Garside Vol.6 No. August 1, 2007, p. 18 - 28 Application of the Six Sigma Method, Reducing failure modes based on the Highest RPN value in FMEA.
c. Evaluation of the implementation of quality control systems at PT. X, AmeyliaDewiseptiani, JurnalTitra Vol. 1 No. 1, Janurari 2013, pp. 33-40, making a process control system that focuses on the production stages of each machine, as well as the proposed improvements to sampling at each inspection carried out.

2. Methodology

2.1 Research design

PT. NJMX Surabaya. Determining the objectives and benefits of further research data retrieval was carried out for 15 weeks of data processing using the seven tools method, namely check sheet, pareto diagram, fishbone

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diagrams, controlchart so as to obtain data on identifying defects of embossed ceramic type motifs on glaze units.

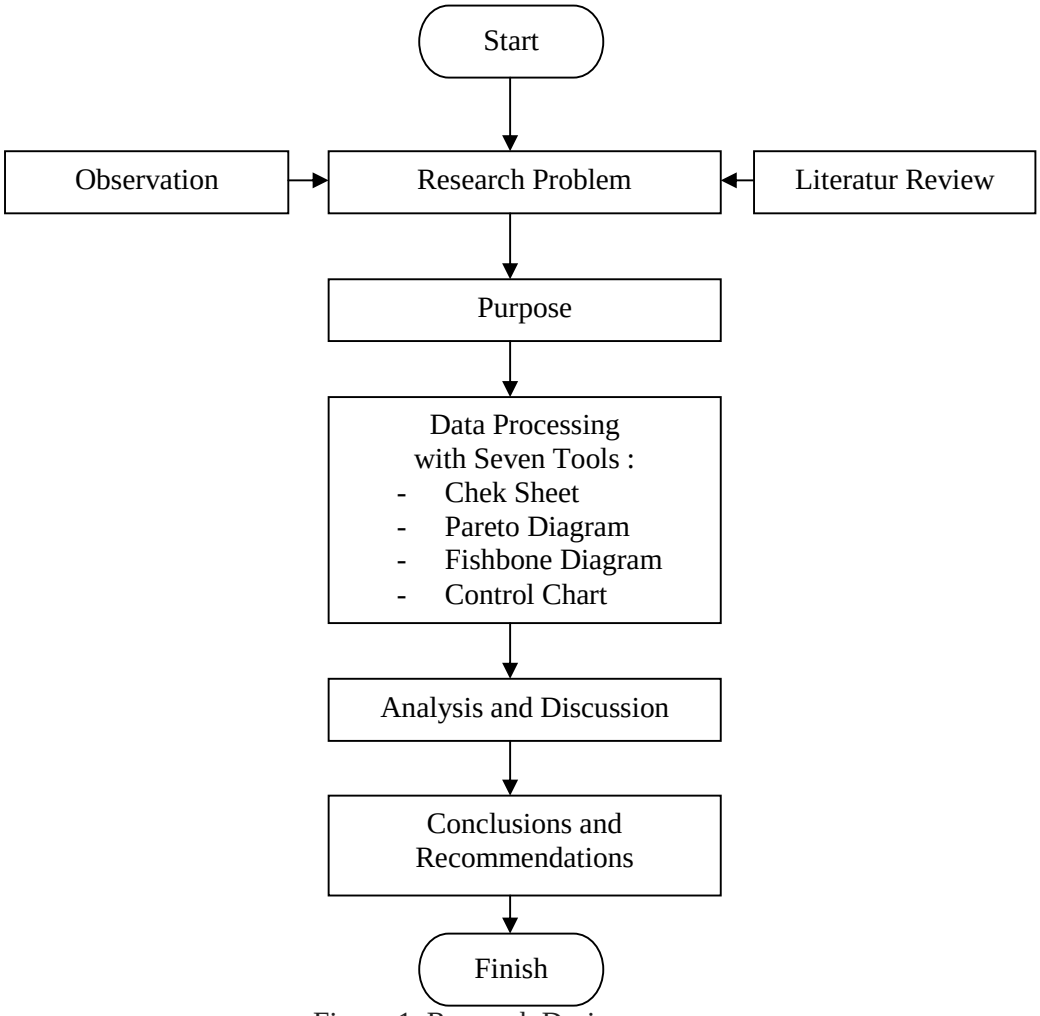

Figure 1. Research Design

2.2 Variables

The research variable is the object of research, or what is the focus of research (Arikunto, 2006: 118). The variables studied must be in accordance with the problems and objectives to be achieved in this study. In this study, two variables are as follows:

a. Disability quality of embossed ceramic products.
b. The seven tools method.

2.3 Population and sample

a. Population according to Ferdinand (2011) is a combination of all elements in the form of events, things or people who have similar characteristics to be the center of attention of a researcher because it is seen as a research universe. The population in this study is the quantity of embossed motifs of 2500 units, size 40 x 40cm in PT. NJMX Surabaya.
b. Understanding the sample according to Sugiyono (2010: 62) "The sample is the number or characteristics of the population for that sample taken from the population must be truly representative or representative of the entire population. The sample used in this study was a ceramic product of embossed motifs measuring 40 x 40 cm, glazed with 1270 units which had defects during the coating process.

2.4 Data Collection Method

The selection of the types of ceramics studied was because the production of ceramics from this company was a job order system (in accordance with customer orders) so that this

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month's production might be different from the following month, while this research focused on the type of ceramic emboss motif size of 40 x 40 cm.

Based on the data that will be used in this study, data collection methods consist of:

a. Obedience directly in the field for 15 weeks.
b. Company historical data in December 2016-March 2017, for the calculation of defect embossed ceramic motifs at the coating process stage, followed by glaze.

3. Results and Discussion

Table 1.
Production data for Glazed Ceramic Products Embossed motifs, Defect amount of ceramics Week 1-15 December 2016 to March 2017 (in Unit Units per Week)

Week	Production	Type of defect					Percentage of defect
		Needle Hole	Striped	Wave	Cracked Glaze	Dimple	
1	13500	47	69	31	32	63	1,79
2	13446	43	68	35	37	33	1,61
3	13488	52	54	44	47	63	1,93
4	13488	69	43	42	67	46	1,98
5	13500	68	47	33	42	69	1,92
6	13572	59	47	44	69	53	2,00
7	13488	73	43	57	48	53	2,03
8	13464	39	45	46	62	51	1,80
9	13566	68	41	37	34	43	1,64
10	13548	63	48	65	38	51	1,96
11	13512	65	39	53	43	66	1,97
12	13488	43	37	44	49	68	1,79
13	13404	72	46	64	48	41	2,02
14	13548	33	56	46	70	43	1,83
15	13518	68	39	42	64	54	1,98
Total	202530	862	722	683	750	797	28,25
Average	13502	57,47	48,13	45,53	50,00	53,13	1,88

Source : Data processed, 2017

3.1 Data Processing

Data processed from the observation table for 15 weeks to find out the percentage of product types rejected by the formula:

% Defect = $\frac{A \quad T \quad a \; D}{A \quad D}$

% Needle Hole = $\frac{5\ ,4}{2}$ X 100 %

% Dimpel = $\frac{5\ ,1}{2}$ X 100 %

=22,60 %

= 20,90%

% Cracked Glaze = $\frac{5}{2}$ X 100 %

% Striped = $\frac{4\ ,1}{2}$ X 100 %

= 19,66%

= 18,93 %

% Wave = $\frac{4\ ,5}{2}$ X 100 %

= 17,91 %

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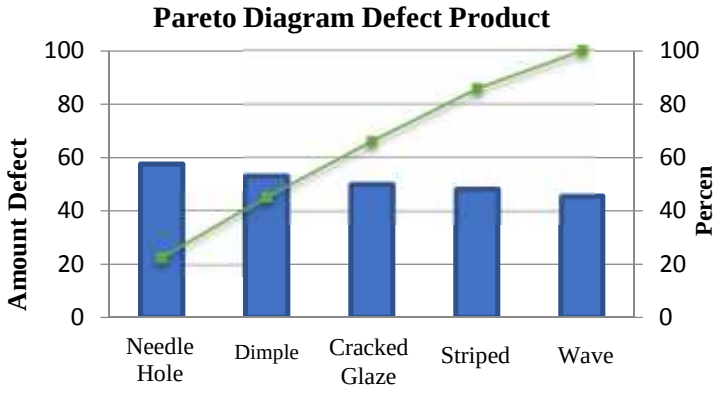

Figure 2. Percentage Type of Defect.

Units of Dimpel, 50 units of cracked glaze, 48 units of lines and 45 units of waves. Of the five types of defects, the highest percentage was pinhole defects with a total percentage of 22.60%, while for dimpel 20.90%, glaze cracks 19.66%, striped 18.93 and waves 17.91%. Repairs can be done by focusing on the single biggest type of defect. This is because the type of defect is a problem of product quality control in the Glaze unit of PT. NJMX for the glaze coating process.

3.1 Analysis Control (X-Bar and R chart)

UCL = $X + A_2 . R$
= 50,8 + (0,577 . 29)
= 50,8 + 16,733
= 67,733

CL = X = 50,8

LCL = $X - A_2 . R$ R
= 50,8 – (0,577 . 29)
= 50,8 – 16,733
= 35,22

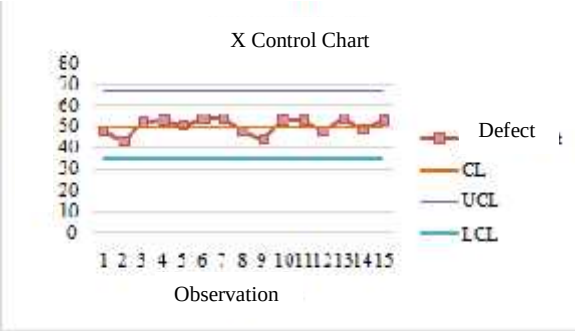

Figure 3. X Control Chart

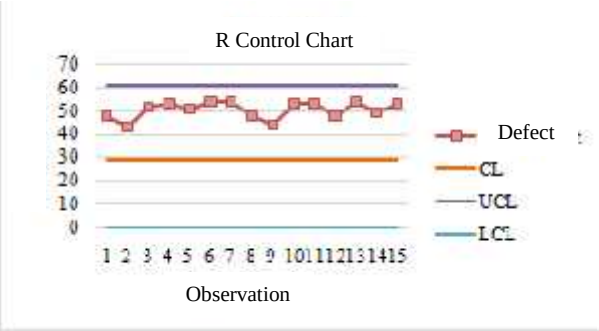

Figure 4. R Control Chart

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UCL = D_4 . R = 2,114 . 29 = 61,309

C = R = 29

LC = D_3 . R = 0. 29 = 0

3.3 Stage Analysis of Cause and Effect Diagrams

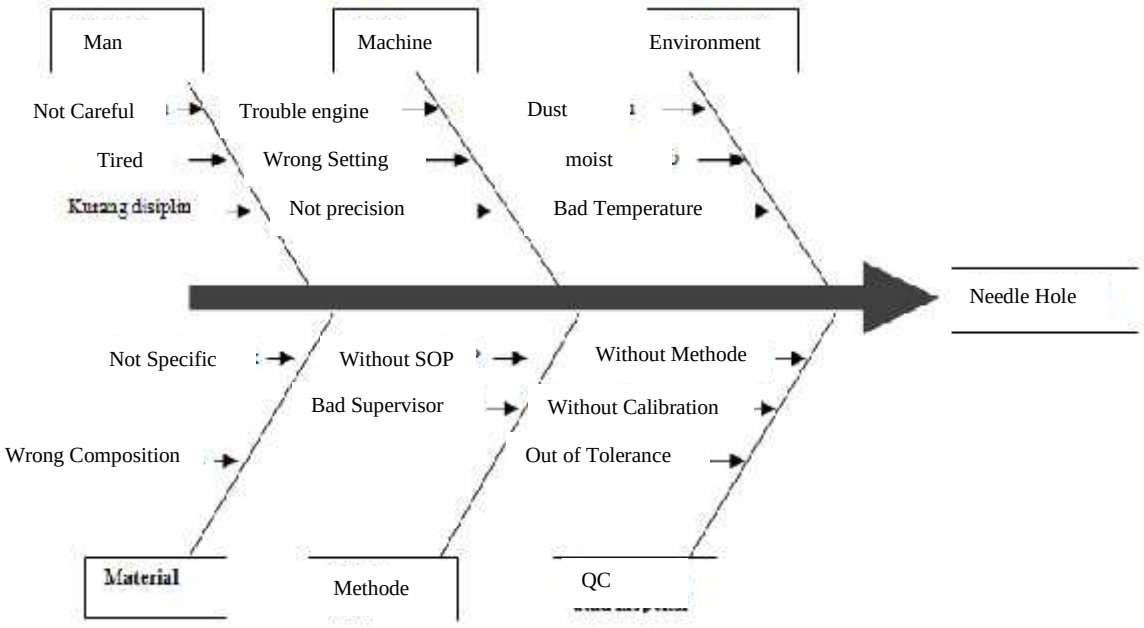

Figure 5. Fish Bone Diagram

3.4 Stage of Measurement of Sigma and Defect Per Million Opportunities (DPMO)

To measure the level of Sigma from the production of Glaze unit PT. NJMX steps are as follows:

DPU (*Defect Per Unit*)

$$DPU = \frac{T \quad D}{T \quad P}$$

DPU (*Defect Per Unit*) in first week

$$DPU = \frac{2}{1} = 0.017925926$$

DPMO (*Defect Per Million Oportunities*)

$$DPMO = \frac{T \quad D \quad P}{T \quad P} \times 1.000.000$$

DPMO (*Defect Per Miliion Oportunities*) first Week

$$DPMO = \frac{2}{1} \times 1.000.000 = 1792,592593$$

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Table 2. DPMO Keramik with Glasir

Week	Total Reject	Total Product	DPU	DPMO	SIGMA
DPU 1	242	13500	0,017925926	1792,5925	3,6
DPU 2	216	13446	0,016064257	1606,4257	3,64
DPU 3	260	13488	0,019276394	1927,6393	3,57
DPU 4	267	13448	0,019795374	1979,5373	3,56
DPU 5	259	13500	0,019185185	1918,5185	3,57
DPU 6	272	13572	0,020041261	2004,1261	3,55
DPU 7	274	13488	0,020314353	2031,4353	3,54
DPU 8	243	13464	0,018048128	1804,8128	3,59
DPU 9	223	13566	0,016438154	1643,8154	3,63
DPU 10	265	13548	0,019560083	1956,0082	3,56
DPU 11	266	13512	0,019686205	1968,6204	3,56
DPU 12	241	13488	0,017867734	1786,7734	3,61
DPU 13	271	13404	0,020217843	2021,7845	3,54
DPU 14	248	13548	0,018305285	1830,5284	3,59
DPU 15	267	13518	0,019751443	1975,1442	3,56
			Total	26272,6185	53,67
			Average	1883,184185	3,53

3.5 Measure

Measure is a measurement phase which is divided into two stages, namely the control diagram analysis phase and the measurement stage of the Sigma and Defect Per Million Opportunities (DPMO) levels. Data taken from PT. NJMX, which is quality control measured by the number of final products. Measurements were made with a control chart of production from December 2016 to March 2017. 1270 sample units used were embouse motif ceramics that had been coated with glaze that had become defective.

3.6 Analyze

Analize is the third stage to improve quality by identifying the cause of damage using pareto diagrams and cause and effect diagrams, based on table 3.1, the highest potential cause of disability is the pinhole with 57 units of total defects, the other causes include 53 units of Dimpel, Cracks glaze 50 units, striped 48 units and wave 45 units. Of the five types of defects, the highest percentage was pinhole defects with a total percentage of 22.60%, while for dimpel 20.90%, glaze cracks 19.66%, striped 18.93 and waves 17.91%.

3.7 Improve

a. Analysis results.

1. Machines are the main cause of defects in ceramic products due to lack of regular maintenance.

2. Lack of understanding of work procedures for the stages of the process.

b. Corrective action taken.

1. The need for repairs that are considered important include all machine instruments that are in the glaze maintenance unit on a regular basis, the availability of spare parts at the time of the replacement process.
2. The need for continuous socialization of SOP (Standard Operating Procedure) for employees and trainin assistance on a regular basis.

3.8 Control

It is the final analysis phase to complete all research and convey the results of the improvement process to up management. Ensure that everyone working is trained to carry out repair procedures.

a. All workers are enticed by the glaze to work based on the instructions of the company leadership.
b. Periodic maintenance of tools, machinery factors that are considered important in supporting the maximum production process in the glaze unit.
c. Total defect products in one month period are listed in the report book so that it can be analyzed by the work leadership.
d. All workers have an awareness of following disciplinary work

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procedures from any aspect while working.

e. Always strive to achieve the best quality in the production process by making a daily report recording the type of defect. By glaze unit workers at the time of production.
f. Supervision in the production process of glaze and engobe materials for all glaze unit employees to produce maximum quality.
g. Coordination between employees when transferring shifts work together to improve work quality
h. The need for socialization to all employees of glaze units will be a good and correct understanding of SOP (Standard Operating Procedure) work.
i. There must be periodic trainning for all glaze unit employees so that procedures while working can be stable.
j. Conducting deliberations every week for employees and leaders, solving problems that arise during the production process and finding solutions to solutions together every week can alternate between shifts.

4. Conclusions

From the Pareto diagram used to identify the biggest defects that occur during the glaze coating stage, the glaze unit is PT. NJMX Surabaya has the highest percentage of the five types of defects. The main defect is the pinhole with a total average of 57 defects, other causes include Dimpel 53 units, Glaze cracks 50 units, Striped 48 units and 45 wave waves. Of the five types of defects, the highest percentage was pinhole defects with a total percentage of 22.60%, while for dimpel 20.90%, glaze cracks 19.66%, striped 18.93 and waves 17.91%. Based on the observation sheet (Check Sheet), it can be seen that the types of defects that often occur are defects due to pinholes with a total number of 862 units, 722 units of stripes, 683 units of waves, 750 units of glaze cracks and 797 units of Dimpel. Data obtained from observations for 15 weeks with an average production of 2250 units per day, with a total production of 202530 for 15 observations. Various kinds of improvement proposals and various ways for the company to reduce product defects are expected to further maximize the production process in the future.

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