

## Taguchi Method Approach To Plastic Bag Production: A Significant Efforts To Reduce Defects In The 24 Size Blowing Process

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### ABSTRAK

Tingkat kecacatan produk plastik pocket ukuran 24 di CV. Prima Jaya Plasindo menjadi penyebab utama permasalahan yaitu pemborosan bahan baku dan inefisiensi produksi. Penelitian ini bertujuan untuk mengidentifikasi dan mengoptimalkan parameter proses produksi yang berkontribusi terhadap kecacatan, dengan menggunakan metode Taguchi. Empat faktor yang diuji yaitu temperatur barrel depan, tengah, dan belakang, serta dosis anti-kelembapan. Desain percobaan menggunakan Orthogonal Array L9(3<sup>4</sup>) dan dianalisis dengan metode Signal to Noise Ratio (SNR) dan Analysis of Variance (ANOVA). Hasil penelitian menunjukkan bahwa faktor yang paling signifikan mempengaruhi kecacatan adalah temperatur barrel depan (kontribusi 65,46%), diikuti oleh anti-kelembapan (19,31%), temperatur barrel tengah (12,34%), dan temperatur barrel belakang (0,83%). Kombinasi parameter optimal yang diperoleh adalah A2 (Suhu Laras Belakang 142°C), B1 (Suhu Laras Tengah 145°C), C1 (Suhu Laras Depan 148°C), dan D1 (Dosis Anti-Kelembapan 102 gram). Konfirmasi percobaan menunjukkan bahwa hasil rata-rata dan nilai SNR berada dalam interval kepercayaan prediksi, yang membuktikan validitas hasil optimasi. Penelitian ini berhasil menunjukkan bahwa penerapan metode Taguchi mampu secara signifikan mengurangi cacat tingkat rendah, terutama cacat bintik putih, dalam proses produksi plastik kantong.

Kata Kunci: Metode Taguchi, peniupan plastik, cacat produksi, optimasi proses, kualitas produk

### ABSTRACT

*The height level product defects pocket plastic Size 24 at CV. Prima Jaya Plasindo become problem main cause waste material standards and inefficiencies production . Research This aim identify and optimize production process parameters that contribute to disabled , with use Taguchi method . Four factors tested that is front , middle , and rear barrel temperatures , as well as anti- humidity dosage . Experimental design using Orthogonal Array L9(3<sup>4</sup>) and analyzed with Signal to Noise Ratio (SNR) and Analysis of Variance (ANOVA) methods . The results show that the most significant factor influence disabled is front barrel temperature ( 65.46% contribution ) , followed by anti- humidity ( 19.31% ) , middle barrel temperature ( 12.34% ) , and rear barrel temperature ( 0.83% ) . The optimal parameter combination obtained are A2 ( Rear Barrel Temperature 142°C ) , B1 ( Middle Barrel Temperature 145°C ) , C1 ( Front Barrel Temperature 148°C ) , and D1 ( Anti- Moisture Dosage 102 grams ) . Experiment confirmation show that average results and SNR values are within the confidence interval predictions , which prove validity results optimization . Research This succeed show that implementation Taguchi method in significant capable lower level defects , especially disabled spots white , in production process pocket plastic .*

*Keywords : Taguchi method, plastic blowing , defects production , process optimization , quality product*

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### INTRODUCTION

High disability also has an impact directly on productivity and sustainability company . Some approach statistics and engineering quality has developed For overcome problem including Six Sigma ,

FMEA, and Taguchi Design of Experiment (DOE) (Hendra & Effendi, 2018; Haslindah et al., 2021). The Taguchi method, in particular, is considered effective in finding the optimal process parameters by using Minimum Experimental Design (Soejanto, 2019; Hendra & Vidhia, 2021). Various studies state that this method is capable of reducing variability and increasing process stability in sector manufacturing like food, metal, textiles, and plastic (Budi, 2019; Irwansyah & Samosir, 2020; Setyanto & Lukodono, 2017).

CV. Prima Jaya Plasindo, a company engaged in production of plastic pockets, facing challenges significant related height defect rate on plastic bags size 24. Historical data company show fluctuations consistent defects tall from month to month, which resulted in a decrease efficiency production as well as improvement wasted material costs.

Although Taguchi method has been used in various sector industry, its application in a way specific for optimizing plastic blowing process parameters pocket size 24 still not yet been researched. Not yet available analysis comprehensive about factors main influencing factors product defects this, and how optimal parameter combination can be lower number of defects in significant. Therefore that, the formulation problem in study is: "What process factors only the most significant contribute against defects in the bag plastic size 24, and how optimal parameter combination for minimize the defects?"

The purpose of study is for identify dominant production process factors influence level defect in the pouch plastic size 24 and determine optimal combination of process parameters using Taguchi method.

Study is expected give contribution practical for industry plastic in control quality product in a way systematically, at the same time give contribution academic to development implementation Taguchi method in industry manufacturing based polymer.

## RESEARCH METHODOLOGY

This research used a quantitative experimental approach with the Taguchi Design of Experiment (DOE) method. The study was conducted at CV. Prima Jaya Plasindo, Depok, from June to November 2020. The experiment focused on the blowing process of size 24 plastic bags, which exhibited the highest defect rate.

The four main factors analyzed were Front Barrel Temperature, Middle Barrel Temperature, Rear Barrel Temperature, and Anti-Moisture Dosage, each consisting of three levels. The experimental design used an Orthogonal Array  $L_9(3^4)$  with a total of nine test combinations. Each combination was replicated three times to ensure data validity.

Data were collected through direct observation, operator interviews, and company production report documentation. Analysis was performed using the Signal-to-Noise Ratio (SNR) approach to

measure system stability and Analysis of Variance (ANOVA) to determine the significance of each factor's contribution to the number of defects. Data calculations and analysis were performed using Minitab 19 software.

After obtaining the optimal combination, a confirmation experiment was conducted to validate the results by comparing the predicted and actual values using a 95% confidence interval for the mean and SNR. Validation aims to ensure that the proposed improvements significantly reduce product defects.

## RESULTS AND DISCUSSION

Manufacturing defects in the product pocket plastic size 24 at CV Prima Jaya Plasindo show fluctuating pattern every month . Based on an interview with workers , causes main disabled the is mixing materials that are not in accordance during the production process . Of the total production amounting to 160,608 kg, recorded as much as 15,955 kg is product defects , as shown in Table 1.

For understand level defects that occur in the product pocket plastic size 24 at CV. Prima Jaya Plasindo , done production and defect data collection from month December 2019 to November 2020. This data represent condition real production in period One years and become base beginning For identification problem . Defects noted in the form of total weight products that are not in accordance specifications and not worthy processed more Continued . Details amount production and quantity defects per month shown in Table 1.

Table 1. Monthly Plastic Factory Production and Defect Data

| No     | Month            | Size | Amount Production (Kg) | Number of Production Defects (Kg) | Percentage % |
|--------|------------------|------|------------------------|-----------------------------------|--------------|
| 1      | December (2019)  | 24   | 15,120                 | 1,280                             | 8.02         |
| 2      | January (2020)   | 24   | 15,120                 | 1,130                             | 7.08         |
| 3      | February (2020)  | 24   | 15,120                 | 1,430                             | 8.96         |
| 4      | March (2020)     | 24   | 16,080                 | 1,620                             | 10.15        |
| 5      | April (2020)     | 24   | 7,680                  | 700                               | 4.39         |
| 6      | May (2020)       | 24   | 6,192                  | 687                               | 4.31         |
| 7      | June (2020)      | 24   | 15,696                 | 1,720                             | 10.78        |
| 8      | July (2020)      | 24   | 13,680                 | 1,267                             | 7.94         |
| 9      | August (2020)    | 24   | 16,080                 | 1,952                             | 12.23        |
| 10     | September (2020) | 24   | 12,480                 | 1,462                             | 9.16         |
| 11     | October (2020)   | 24   | 13,680                 | 1,428                             | 8.95         |
| 12     | November (2020)  | 24   | 13,680                 | 1,279                             | 8.02         |
| Amount |                  |      | 160,608                | 15,955                            | 100          |

( Source : CV. Prima Jaya Plasindo , 2020 )

From Table 1 it can be seen that seen that amount disabled highest occurred in August 2020 amounting to 1,952 kg from a total production of 16,080 kg, with percentage disabled reached 12.23%. On the other hand , May 2020 recorded percentage disabled lowest amounting to 4.31% of the total production of 6,192 kg. In general overall , total production during period the reached 160,608 kg with total defects of 15,955 kg or around 9.93% of total production . This data show that fluctuations disability Enough tall between month , and size 24 becomes size with level disabled highest compared to size others , so that become focus main study . For give visual depiction of performance production and level disability products , historical data production plastic sizes 24, 28, and 32 of month December 2023 to November 2024 mapped in form graph . Visualization This aim For show trend disability in a way common to all three size product pocket Plastic produced by CV. Prima Jaya Plasindo . Graphics this is also used For identify size which products are the most critical in matter amount disabled and need become priority process improvement .

For evaluate stability of the production process pocket plastic size 24, done analysis using the P Control Chart (Proportion Chart). This tool functioning For monitor whether variation disabled still in process is at in limit control that can accepted or show existence signal uncontrollable . Faulty data monthly that has been collected from December 2019 to November 2020 then processed to in form map control For get visualization stability of the production process from time to time that can seen in figure 1.

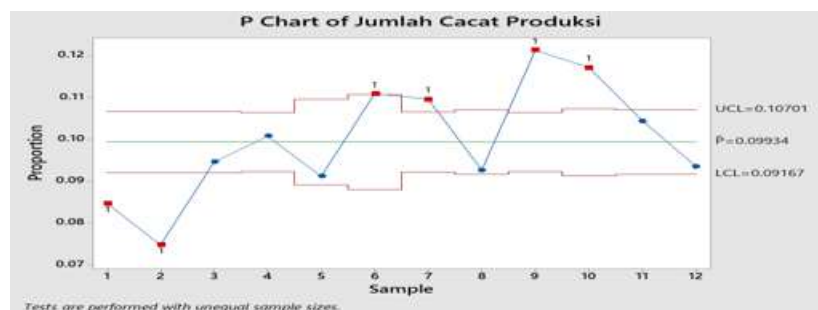


Figure 1. Plastic Bag Control Map Size 24

( Source : Data Processing Results, 2021)

Based on Figure 1 , several points above indicate potential process variations that require attention. These results reinforce the urgency of optimizing process parameters to reduce variation and defect frequency, particularly during high-defect production periods.

After determining the overall defect rate, the next step in the analysis is to identify the dominant types of defects found in size 24 plastic bags. This is crucial for determining which defect types should be prioritized for production process improvements. The data in Table 2 shows a classification of the number of defects based on the type of damage found during the production process.

Table 2. Processing of Defective Product Data for Size 24 Plastic Bags

| Type of Defect      | Number of Defects |
|---------------------|-------------------|
| Thin on One Side    | 2,124 kg          |
| Scroll Disconnected | 958 kg            |
| White Spots         | 12,873 kg         |

(Source : CV. Prima Jaya Plasindo , 2020)

From Table 2 it can be seen that type the most dominant defect is spots white , with total defects as much as 12,873 kg, or almost 81% of the total defects . Thin defects on one side and rolls disconnected each contributed 2,124 kg and 958 kg respectively. Dominance spots white as reason main disabled become base determination focus analysis next , namely identify the most contributing process factors to emergence spots white on the bag plastic size 24.

To support the visual analysis of the Pareto Diagram, the data was organized into a cumulative frequency table to facilitate determining the priority order for defect management. This table presents complete information on the number of defects of each type, the cumulative frequency in kilograms, and their cumulative percentage of the total defects. This presentation is important as a quantitative basis for selecting the most appropriate defect types to focus on in efforts to improve the quality of the 24-pack plastic bag production process.

Table 3 Processing of Defective Plastic Bag Product Data After Pareto Diagram

| No    | Type of Defect   | Number of Defects | Cumulative Defect Amount | Defective Proposition | Cumulative Disability Proportion |
|-------|------------------|-------------------|--------------------------|-----------------------|----------------------------------|
| 1     | White Spots      | 12,873            | 12,873                   | 80.68%                | 80.68%                           |
| 2     | Thin on One Side | 2.124             | 14,997                   | 13.31%                | 94%                              |
| 3     | Scroll Separated | 958               | 15,955                   | 6%                    | 100%                             |
| Total |                  |                   | 15,955                   | Total                 | 100%                             |

( Source : Data Processing Results, 2021)

Table 3 shows that white spot defects rank first with a frequency of 12,873 kg, accounting for 80.68% of the total number of defects. The thin-one-side defect is in second place with a contribution of 13.31%, followed by broken rolls at 6%. Cumulatively, these three types of defects account for 100% of the total product defects. Therefore, quality improvements aimed at addressing white spot defects are certain to have the greatest impact on reducing the total product defect rate in the company.

After classifying the defect types and calculating their frequency and contribution to total defects, further analysis was performed using a Pareto Diagram. This diagram aims to visualize the dominance of defect types based on the 80:20 principle, where a large proportion of effects are caused by a small number of causes. By using this approach, companies can focus resources on the primary causes of defects that have the greatest impact. Figure 2 below shows the order of contribution of each defect type to the total defects in the production of size 24 plastic bags.



Figure 2. Pareto Diagram of the Number of Types of Defects in Plastic Bags Size 24

Figure 2 shows with clear that disabled spots white is reason dominant from overall disability , with a very dominant contribution , namely more from 80%. Type of defect other like thin on one side and rolled disconnected own far reaching contribution more small . The cumulative curve in the diagram shows that with control disabled spots white only , company potential lower more of 80% of total disability . Findings This become base For determine focus experiment process optimization in research , namely on the factors that influence emergence disabled spots white .

Once determined that disabled spots white is focus main repair , steps furthermore in Taguchi method is compile design experiment based on factors that are considered influence quality product . Research This choose four factor Main factors : rear barrel temperature , middle barrel temperature , front barrel temperature , and anti- humidity dosage . Each factor tested in three levels, namely low , medium , and high . This level of coding important For compile combination in the orthogonal array L9 and simplify the analysis process statistics . Details code and value current from each level for each factor shown in Table 4 below .

Table 4. *Full Factorial Design* variable value *level* code

| Factor                    | Level       |
|---------------------------|-------------|
|                           | Temperature |
| Rear Barrel Temperature   | 140°C       |
| Middle Barrel Temperature | 145°C       |
| Front Barrel Temperature  | 148°C       |
| Anti- Damp Dosage         | 102 Gram    |

(Source : Data Processing Results, 2021)

Table 4 shows that the barrel temperature and moisture-proofing dosage were systematically varied across three levels. For example, the front barrel temperature was set at 148°C for the high level, while the moisture-proofing dosage was set at a maximum of 102 grams. These variations between levels serve as the basis for observing the influence of each factor on changes in the number of white spot defects. By constructing an experimental design based on these levels, the study can efficiently evaluate both the direct and interactive effects of factors on product quality characteristics.

Based on the previously determined factor and level design, an experiment was conducted using the L9(3<sup>4</sup>) Orthogonal Array design. Each combination was run in three replications to ensure

consistency of results and reduce the influence of random variability. The resulting data were in the form of the number of white spot defects from each experimental combination, which were then calculated for the total and average values. The complete results of the experimental implementation are shown in Table 5 below.

Table 5. *Orthogonal Array* and Result Data

| Run   | <i>Level</i> |   |   |   | Amount of Material Tested (Kg) | Number of White Spot Defects (Gram) |     |     | Total Defects (Gram) | Average Defect (Gram) |
|-------|--------------|---|---|---|--------------------------------|-------------------------------------|-----|-----|----------------------|-----------------------|
|       | A            | B | C | D |                                | R1                                  | R2  | R3  |                      |                       |
| 1     | L            | L | L | L | 24                             | 144                                 | 153 | 146 | 443                  | 147.67                |
| 2     | L            | M | M | M | 24                             | 294                                 | 292 | 309 | 895                  | 298.33                |
| 3     | L            | H | H | H | 24                             | 326                                 | 346 | 365 | 1037                 | 345.67                |
| 4     | M            | L | M | H | 24                             | 241                                 | 206 | 242 | 689                  | 229.67                |
| 5     | M            | M | H | L | 24                             | 289                                 | 274 | 261 | 824                  | 274.67                |
| 6     | M            | H | L | M | 24                             | 257                                 | 255 | 244 | 756                  | 252.00                |
| 7     | H            | L | H | M | 24                             | 332                                 | 343 | 327 | 1002                 | 334.00                |
| 8     | H            | M | L | H | 24                             | 179                                 | 204 | 221 | 604                  | 21.33                 |
| 9     | H            | H | M | L | 24                             | 289                                 | 258 | 259 | 806                  | 268.67                |
| Total |              |   |   |   |                                |                                     |     |     |                      | 2352                  |

(Source : Data Processing Results, 2021)

Next , the data in Table 5 is used For compile Table 6, which contains results average response analysis to each factor level use Taguchi approach .

Table 6. ANOVA Response Table of Average of Influence of Factors

| <i>Level</i>   | Influence |       |       |       |
|----------------|-----------|-------|-------|-------|
|                | A         | B     | C     | D     |
| <i>Level 1</i> | 263.9     | 237.1 | 200.3 | 230.3 |
| <i>Level 2</i> | 252.1     | 258.1 | 265.6 | 294.8 |
| <i>Level 3</i> | 268.0     | 288.8 | 318.1 | 258.9 |
| Difference     | 15.9      | 51.7  | 117.8 | 64.4  |
| Rank           | 4         | 3     | 1     | 2     |

( Source : Data Processing Results, 2021)

The results in Table 6 show that factor C (Front Barrel Temperature) has the greatest influence on the number of defects, with an average difference between levels of 117.8 grams, followed by factor D (Anti-Moisture Dosage) of 64.4 grams. Factors B (Middle Barrel Temperature) and A (Rear Barrel Temperature) have smaller contributions. The ranking of the influence between these factors serves as the initial basis for identifying the dominant factor before conducting statistical significance testing. Analysis of Variance (ANOVA) is used to analyze the significance of each factor's contribution to the variation in the average response, which is presented in Table 7 below.

Table 7. ANOVA Table For Mean Value

| Source  | SS        | DB | MS        | F- Ratio | SS'        | Ratio % | F- Table |
|---------|-----------|----|-----------|----------|------------|---------|----------|
| A       | 1,226.58  | 2  | 633.29    | 2.85     | 795,726    | 0.83    | 3.55     |
| B       | 12,169.14 | 2  | 6,084.57  | 28.24    | 11,738,286 | 12.34   | 3.55     |
| C       | 62,691.54 | 2  | 31,345.77 | 145.50   | 62,260,686 | 65.46   | 3.55     |
| D       | 18,801.06 | 2  | 9,400.53  | 43.64    | 18,370,206 | 19.31   | 3.55     |
| E       | 3,877.68  | 18 | 215,4267  | 1        | 1938.84    | 2.06    |          |
| SSt     | 95,103.75 | 26 | 3,657.84  |          | 95,104     |         |          |
| Mean    | 1,843,968 | 1  |           |          |            |         |          |
| SSTotal | 1,939,072 | 27 |           |          |            |         |          |

( Source : Data Processing Results, 2021)

Based on the ANOVA results in Table 7, it is known that Front Barrel Temperature (factor C) provides the most dominant contribution to the variation of defects, namely 65.46%, with a calculated F value that far exceeds the F table. Factor D (Anti-Moisture Dosage) contributes 19.31%, followed by factor B (Middle Barrel Temperature) at 12.34%, and the ratio Factor A (Rear Barrel Temperature) was only 0.83%. These values indicate that the two main factors that need to be focused on in process improvement are front barrel temperature and increasing moisture-proofing dosage . To increase the reliability of the results, pooling was performed for errors and insignificant factors, the results of which are presented in Table 8 below.

Table 8. ANOVA Table For *Pooling* Mean

| Source   | Pooled | SS        | DB | MS        | F- Count | SS'       | Ratio% | F Table |
|----------|--------|-----------|----|-----------|----------|-----------|--------|---------|
| A        | Y      |           |    |           |          |           |        |         |
| B        | Y      |           |    |           |          |           |        |         |
| C        |        | 62,691.54 | 2  | 31,345.77 | 39.92306 | 61,121.23 | 64.27% | 3.44    |
| D        |        | 18,801.06 | 2  | 9,400.53  | 11.97284 | 17,230.75 | 18.11% | 3.44    |
| Pooled e |        | 17,273.4  | 22 | 785,1545  | 1        | 16,752.02 | 17.62% |         |
| SSt      |        | 95,103.75 | 26 | 3,657     |          | 95,104    |        |         |
| Mean     |        | 1,843,968 | 1  |           |          |           |        |         |
| SSTotal  |        | 1,939,072 | 27 |           |          |           |        |         |

( Source : Data Processing Results, 2021)

The results of the next SNR calculation will be shown in **Table 9.** below this.

Table 9. ANOVA Table For *Pooling* Mean

| No | Factor |   |   |   | Replication |     |     | $\bar{y}$ | $\sigma$ | $\eta$   |
|----|--------|---|---|---|-------------|-----|-----|-----------|----------|----------|
|    | A      | B | C | D | R1          | R2  | R3  |           |          |          |
| 1  | 1      | 1 | 1 | 1 | 144         | 153 | 146 | 147,6667  | 14,88889 | -17,6427 |
| 2  | 1      | 2 | 2 | 2 | 294         | 292 | 309 | 298,3333  | 57,55556 | -19,6788 |

| No | Factor |   |   |   | Replication |     |     | $\bar{y}$ | $\sigma$ | $\eta$   |
|----|--------|---|---|---|-------------|-----|-----|-----------|----------|----------|
|    | A      | B | C | D | R1          | R2  | R3  |           |          |          |
| 3  | 1      | 3 | 3 | 3 | 326         | 346 | 365 | 345,6667  | 253,5556 | -20,1052 |
| 4  | 2      | 1 | 2 | 3 | 241         | 206 | 242 | 229,6667  | 280,2222 | -18,9215 |
| 5  | 2      | 2 | 3 | 1 | 289         | 274 | 261 | 274,6667  | 130,8889 | -19,439  |
| 6  | 2      | 3 | 1 | 2 | 257         | 255 | 244 | 252       | 32,66667 | -19,1901 |
| 7  | 3      | 1 | 3 | 2 | 332         | 343 | 327 | 334       | 44,66667 | -20,0058 |
| 8  | 3      | 2 | 1 | 3 | 179         | 204 | 221 | 201,3333  | 297,5556 | -18,5402 |
| 9  | 3      | 3 | 2 | 1 | 289         | 258 | 259 | 268,6667  | 206,8889 | -19,3756 |

(Source : Data Processing Results, 2021)

U for the response table results results SNR calculations can be seen in Table 10 .

Table 10. SNR Calculation Result Response Table

| Level      | Influence |        |        |        |
|------------|-----------|--------|--------|--------|
|            | A         | B      | C      | D      |
| Level 1    | -19.14    | -18.86 | -18.46 | -18.82 |
| Level 2    | -19.18    | -19.22 | -19.33 | -19.62 |
| Level 3    | -19.31    | -19.56 | -19.85 | -19.19 |
| Difference | 0.16      | 0.7    | 1.39   | 0.81   |
| Rank       | 4         | 3      | 1      | 2      |

(Source : Data Processing Results, 2021)

Table 11 Below are the complete results of the ANOVA calculations for SNR on white spot defects.

Table 11. ANOVA Pooling SNR Value Table

| Source   | Pooled | SS       | DB | MS     | Fratio | SS'   | Ratio% |
|----------|--------|----------|----|--------|--------|-------|--------|
| A        | Y      |          |    |        |        |       |        |
| B        | Y      |          |    |        |        |       |        |
| C        |        | 3.75     | 2  | 1,875  | 20.08  | 3.56  | 75.44% |
| D        |        | 0.59     | 2  | 0.299  | 3.21   | 0.41  | 8.74%  |
| Pooled e |        | 0.3733   | 4  | 0.0933 | 1      | 0.746 | 15.82% |
| SSt      |        | 4,7231   | 8  | 0.590  |        | 4,716 |        |
| Mean     |        | 3321,579 | 1  |        |        |       |        |
| SSTotal  |        | 3326,302 | 9  |        |        |       |        |

(Source : Data Processing Results, 2021)

From the analyses conducted, two optimal adjustment designs were obtained, namely a combination of *levels* that can be used to improve quality characteristics, namely variance and adjusting targets according to expectations. Table 12 below shows a comparison of the influence of factors in the experiments carried out on the observed quality characteristics.

Table 12 Comparison Table of Influence of Factors on Quality Characteristics

| Factor | Rank Order  |         | Influence                           | Selected Level/Setting |
|--------|-------------|---------|-------------------------------------|------------------------|
|        | For Average | For SNR |                                     |                        |
| A      | (4)         | (4)     | No effect                           | A2                     |
| B      | (3)         | (3)     | Influential and Small Contributions | B1                     |
| C      | (1)         | (1)     | Influential and Great Contribution  | C1                     |

|   |     |     |                                    |    |
|---|-----|-----|------------------------------------|----|
| D | (2) | (2) | Influential and Great Contribution | D1 |
|---|-----|-----|------------------------------------|----|

(Source : Data Processing Results, 2021)

After obtaining the experimental results in the form of *optimal Level settings* , the next step is to calculate and compare the confidence values for the average value and SNR for both the prediction and confirmation experiments to test the validity of the research results. The results of the comparison between the confirmation and prediction experiments are acceptable because the values are still within the range of the average prediction and SNR. The following summary of the interpretation of the calculation results for the prediction and optimization values is shown in Table 13 below.

Table 13. Interpretation Table of Results of Prediction and Optimization of White Spot Defect Calculation

| White Spot Defect Response |         | Prediction | Optimization  | Confidence Interval   |
|----------------------------|---------|------------|---------------|-----------------------|
| Experiment <i>Taguchi</i>  | Average | 169.93     | $\pm 25,0043$ | $144.9257 > 194.9343$ |
|                            | SNR     | -18,069    | $\pm 0.6321$  | $-18.7011 > -17.4369$ |
| Experiment Confirmation    | Average | 256.5      | $\pm 31.0295$ | $225.4704 > 287.5295$ |
|                            | SNR     | -14,057    | $\pm 0.6867$  | $-14.7435 > -13.3701$ |

(Source : Data Processing Results, 2021)

Based on Table 13 above, the average and SNR values from the *Taguchi experiment* and the confirmation experiment are valid and acceptable, this is because there is an overlap between the two values. By using this *Taguchi experiment* , several plastic spot defect values that were previously too high have been corrected.

## CONCLUSION

This study aims to identify process factors that influence defects in 24-size plastic bag products at CV. Prima Jaya Plasindo and determine the optimal combination of process parameters to reduce the defect rate using the Taguchi method. Based on the analysis results, it is known that the most dominant type of defect is white spot defects, with a contribution of 80.68% of the total defects, so it is determined as the main focus of improvement. Through the L9(3<sup>4</sup>) experimental design, four factors were tested, namely the front, middle, and rear barrel temperatures, and the anti-moisture dosage. The ANOVA results showed that the most significant factor influencing defects was the front barrel temperature with a contribution of 65.46%, followed by the anti-moisture dosage of 19.31%, the middle barrel temperature 12.34%, and the rear barrel temperature 0.83%. The optimal combination of process parameters was obtained at a rear barrel temperature of 142°C, a middle barrel of 145°C, a front barrel of 148°C, and an anti-moisture dosage of 102 grams. Confirmatory experiments demonstrated that the average defect rate and SNR values were within the predicted confidence interval, indicating that the optimization results

were valid and applicable. Thus, the Taguchi method proved effective in reducing defect rates, particularly white spot defects, and improving overall production process efficiency and quality.

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