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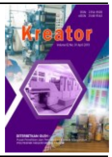

Analysis of the Implementation of the PDCA Method to Minimize Delamination Complaints in Oilpacks Products at PT XYZ

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ABSTRAK

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Penelitian ini bertujuan untuk menganalisis efektivitas penerapan metode PDCA (Plan-Do-Check-Act) dalam menurunkan jumlah keluhan delaminasi pada produk Oilpack di PT XYZ. Delaminasi merupakan salah satu jenis cacat produk yang berdampak langsung terhadap mutu, daya tahan kemasan, serta tingkat kepuasan pelanggan. Jika tidak ditangani secara sistematis, masalah ini dapat menurunkan citra perusahaan dan meningkatkan biaya produksi akibat rework maupun klaim pelanggan. Oleh karena itu, diperlukan pendekatan perbaikan berkelanjutan yang terstruktur dan terukur. Melalui tahapan PDCA, penelitian ini berhasil mengidentifikasi penyebab utama terjadinya delaminasi, yaitu kualitas bahan baku yang tidak konsisten, ketidaksesuaian parameter proses produksi, serta lemahnya pengawasan pada tahapan tertentu. Pada tahap Plan dilakukan analisis akar masalah menggunakan data historis keluhan pelanggan. Tahap Do mencakup implementasi tindakan korektif berupa peningkatan pengendalian mutu bahan baku, penguatan kontrol proses produksi, serta pelatihan karyawan terkait standar operasional prosedur (SOP). Tahap Check dilakukan dengan mengevaluasi dan membandingkan data keluhan sebelum dan sesudah perbaikan, sedangkan tahap Act menetapkan standar kerja baru sebagai langkah pencegahan berulang. Hasil penelitian menunjukkan penurunan keluhan dari 16% menjadi rata-rata 5%. Jumlah keluhan mingguan juga menurun dari 10 menjadi 6 kasus (penurunan 40%), sehingga membuktikan bahwa metode PDCA efektif dalam meningkatkan pengendalian mutu dan efisiensi proses produksi.

ABSTRACT

This study aims to analyze the effectiveness of implementing the PDCA (Plan-Do-Check-Act) method in reducing the number of delamination complaints in Oilpack products at PT XYZ. This study aims to analyze the effectiveness of implementing the PDCA (Plan-Do-Check-Act) method in reducing the number of delamination complaints in Oilpack products at PT XYZ. Delamination is a type of product defect that directly affects product quality, packaging durability, and customer satisfaction. If not addressed systematically, this issue can reduce the company's reputation and increase production costs due to rework and customer claims. Therefore, a structured and measurable continuous improvement approach is required. Through the PDCA stages, this study identified the main causes of delamination, including inconsistent raw material quality, nonconformities in production process parameters, and weak monitoring at certain stages of production. In the Plan stage, root cause analysis was conducted using historical customer complaint data. The Do stage involved implementing corrective actions such as improving raw material quality control, strengthening production process control, and providing employee training related to standard operating procedures (SOP). The Check stage evaluated the results by comparing complaint data before and after the improvement process, while the Act stage established new work standards to prevent similar issues from recurring. The results show that complaints decreased from 16% to an average of 5%.

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Weekly complaints also declined from 10 to 6 cases, representing a 40% reduction, indicating that the PDCA method is effective in improving quality control and production process efficiency.

1. INTRODUCTION

Under actual field conditions, products that do not meet established quality standards are still found. Some of these products even pass internal quality control processes and are delivered to customers, resulting in complaints that require serious attention. Therefore, a comprehensive investigation is necessary to identify the root causes of the problem (why it happened) and to determine why the defective products were able to pass the quality control process (why it passed). One concrete example of quality issues at PT XYZ is the delamination defect in oilpack products. This defect not only affects the packaging appearance but also reduces the perceived product quality and potentially compromises product safety during its shelf life. To address this issue, the company has implemented the PICA (Problem Identification and Corrective Action) system as a systematic approach to quality improvement. However, in practice, PICA has not consistently provided long-term solutions. This may be due to insufficient root cause analysis, limitations in the execution of corrective actions, and weak monitoring of implementation results in the field. As a result, several issues have reoccurred in the form of repeated complaints, including persistent delamination despite corrective measures, indicating weaknesses in the quality control system and the effectiveness of PICA. Therefore, a comprehensive evaluation of the PICA process is required in terms of the accuracy of problem identification, the appropriateness of corrective actions, and the reliability of the prevention system.

Delamination is a common issue in flexible packaging for oilpack products, caused by weak bonding between plastic film layers, leading to packaging leakage and potential financial losses. Based on complaint data from Plant 1 of PT XYZ in 2024, delamination was the primary cause of complaints during the June–September 2024 period, highlighting the urgency of addressing this issue. In this context, the implementation of the PDCA (Plan-Do-Check-Act) method becomes highly relevant, as it integrates root cause analysis, risk prioritization, and corrective action planning. Previous research has shown that the application of PDCA reduced product defects from 0.085 to 0.030 DPU, meeting company standards (Utami & Djamal, 2018).

However, previous studies have not specifically focused on delamination issues. For instance, Nugroho & Nugroho (2020) analyzed the reduction of reject rates without deeply identifying the root causes of delamination. Therefore, this study focuses on implementing PDCA to address oilpack product delamination using an integrated and specific approach aligned with the characteristics and challenges at PT Indofood CBP Sukses Makmur. By presenting empirical data and evidence-based recommendations, this study is expected to contribute to continuous improvement within the company and serve as a reference for other packaging industries in implementing more effective quality control strategies. Based on the literature review, no prior research has specifically implemented PDCA to address delamination as a primary priority in quality control. Previous studies have generally discussed defect rates in aggregate without prioritization based on defect dominance. This gap highlights the need for a more focused and specific study on delamination as a major contributor to production defects. Therefore, this research offers a novel contribution by positioning delamination as the main focus of analysis and integrating the PDCA stages to develop more measurable and effective improvement strategies.

The method used is **PDCA (Plan, Do, Check, Act)**, involving direct observation and interviews with operators. According to Taufik (2020), the PDCA (Plan-Do-Check-Act) method is a continuous improvement cycle that is future-oriented, flexible, logical, and structured to realize the planned objectives.

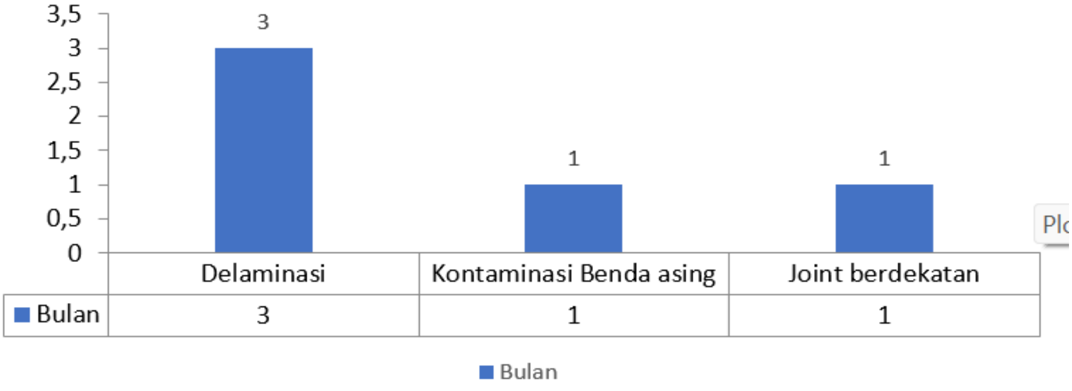

Figure 1. Frequency of Customer Complaints, June–September 2024

The data analysis was carried out using **7 quality tools**. In the **Plan** stage, the author used a **cause-and-effect diagram (Fishbone diagram)**. In the **Do** stage, the **5W+1H** approach was used to create improvement proposals. In the **Check** stage, changes were evaluated by comparing data before and after analysis using a **Control Chart**. Before implementing PDCA, the average number of complaints was recorded at **10 cases per week**. After three months of implementation, this number decreased to **6 cases per week**, representing a **40% reduction**. This data supports the effectiveness of the PDCA method in controlling and improving service quality.

2. RESULTS AND DISCUSSION

Plan

The following is the **pass reject data from June to September 2024**. June recorded the highest number of defects, while the subsequent months showed a decline, remaining within the **UCL and LCL** limits.

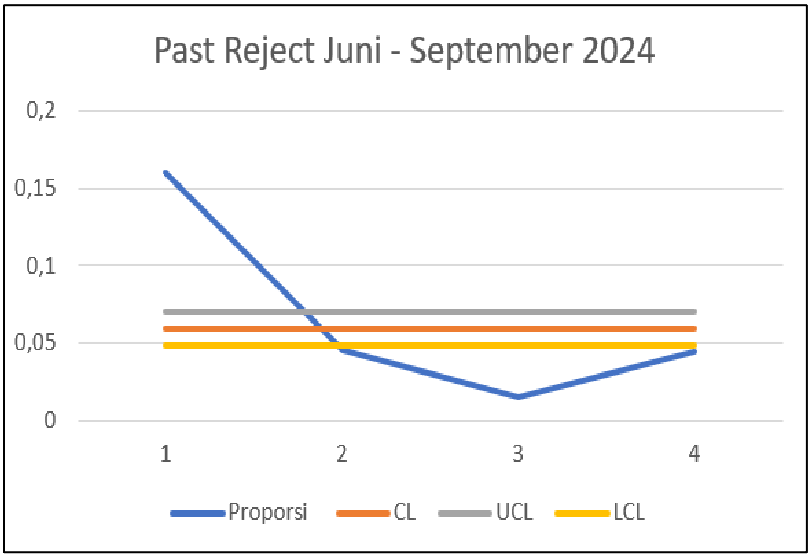

Figure 2. Pass Reject June–September 2024

Table 1. Statistical Quality Control Pass Reject 2024

No.	Month	Production (roll)	Defect (roll)	Proportion	CL	UCL	LCL
1	June 2024	281	45	0.1601423	0.0597505	0.070767	0.048734
2	July 2024	395	18	0.0455696	0.0597505	0.070767	0.048734
3	August 2024	335	5	0.0149254	0.0597505	0.070767	0.048734
4	September 2024	512	23	0.0449219	0.0597505	0.070767	0.048734

Do (Implementation) – 5W + 1H

Factor	What	Why	Who	Where	When	How
Man	Lack of process control	- Operator did not follow standard parameters - Insufficient control over ozone supply - Operators did not clean the extruder hood regularly	Operator	Machine	During process	Briefing regarding ozone supply and periodic extruder hood cleaning
Machine	Insufficient glue supply	- Poor glue circulation - Rubber roll pressure low - Etching cylinder worn	Operator	Machine	During process	- Monitor glue pump circulation and report blockage to section head for immediate repair - Ensure rubber roll pressure meets standard; reject rolls with dents - Replace or re-chrome worn etching cylinder
Supply Ozone	Ozone applicator clogged	- Applicator blocked	Operator	Machine	During process	- Create ozone monitoring checklist - Develop OPL (One Point Lesson) for cleaning applicator
Hood Extruder	Dirty extruder hood	- Parafin deposits from resin vapor	Operator	Machine	During process	- Review WI for hood cleaning and create routine cleaning schedule
Method	No standard cleaning check	- No control over ozone applicator and hood cleaning	Operator	Machine	During process	- Establish standard procedures and cleaning schedules
Parameter	Non-standard parameters	- Machine not calibrated	Operator	Machine	During process	- Notify technical team for calibration and schedule regular machine checks
Material	Incorrect glue/resin mix	- Wrong composition	Operator	Machine	During process	- Ensure correct glue mixing and proper labeling

Factor	What	Why	Who	Where	When	How
		reduces effectiveness				- Focus on PO and resin to avoid mixing errors

Check (Evaluation)

Table 2. Statistical Quality Control Pass Reject June 2024 – January 2025

No.	Month	Production (roll)	Defect (roll)	Proportion	CL	UCL	LCL
1	June 2024	281	45	0.1601423	0.0567086	0.067459	0.045959
2	July 2024	395	18	0.0455696	0.0567086	0.067459	0.045959
3	August 2024	335	5	0.0149254	0.0567086	0.067459	0.045959
4	September 2024	512	23	0.0449219	0.0567086	0.067459	0.045959
5	October 2024	451	23	0.0509978	0.0567086	0.067459	0.045959
6	November 2024	320	5	0.015625	0.0567086	0.067459	0.045959
7	December 2024	606	39	0.0643564	0.0567086	0.067459	0.045959
8	January 2025	521	36	0.0690979	0.0567086	0.067459	0.045959

After applying the PDCA method (Plan, Do, Check, Act), improvements were observed in the **pass reject rate**, which began to stabilize. However, looking at the **defect data**, the graph remained stable initially (October–November 2024) but increased in the following months (December 2024–January 2025). In January, the graph slightly exceeded the **upper limit**. Based on monitoring through the **Control Chart**, some defect data points exceeded the **Upper Control Limit (UCL)**, indicating that the production process was **out of control at certain times**. Although the PDCA method was applied to minimize delamination defects, this anomaly shows that there are still factors causing defects that have not been fully identified and eliminated.

This **Fishbone Diagram** illustrates the possible causes of Delamination grouped into four main categories: Man, Machine, Material, and Method.

- Man: Lack of control during the process.
- Machine:
    - Insufficient glue supply
    - Insufficient ozone supply
    - Dirty extruder hood
- Material: Material not according to specification.
- Method: Parameters not meeting standard and absence of a proper cleaning and inspection procedure.

Each of these categories contributes factors that may lead to the occurrence of delamination defects.

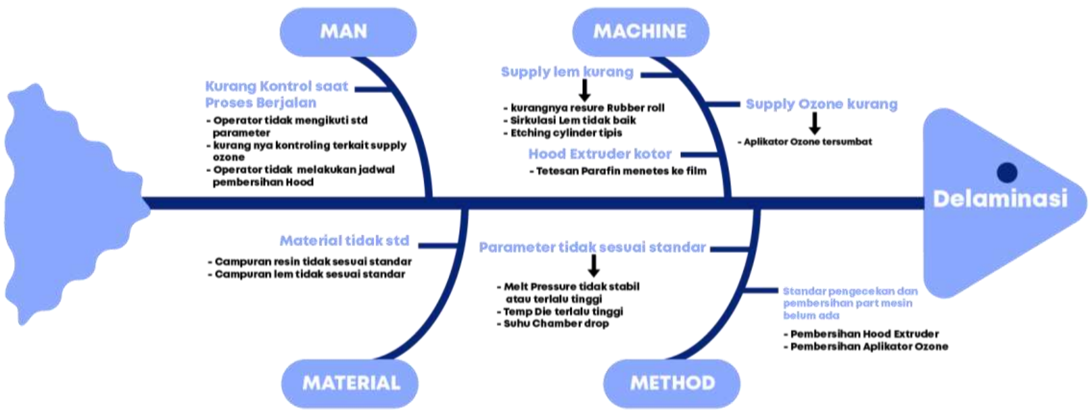

Figure 3. Fishbone Diagram

After the analysis using the PDCA (Plan, Do, Check, Act) method, improvements were observed in the pass reject rate, which began to stabilize. However, looking at the defect data, the graph was stable at first (October–November 2024) but increased in the following months (December 2024–January 2025). In January, the graph slightly exceeded the upper control limit (UCL). Based on monitoring through the **Control Chart**, some defect data points exceeded the **UCL**, indicating that the production process was **out of control at certain times**. Although the PDCA method was applied to minimize delamination defects, this anomaly shows that there are still defect-causing factors that have not been fully identified or eliminated.

Nevertheless, no complaints were recorded during the October 2024 – January 2025 period, indicating that the implemented method had a positive impact. However, based on the control chart analysis, it was observed that during weeks 3 and 4, the proportion of delamination defect exceeded the Upper Control Limit (UCL). This condition indicates the presence of special cause variation rather than normal process fluctuation.

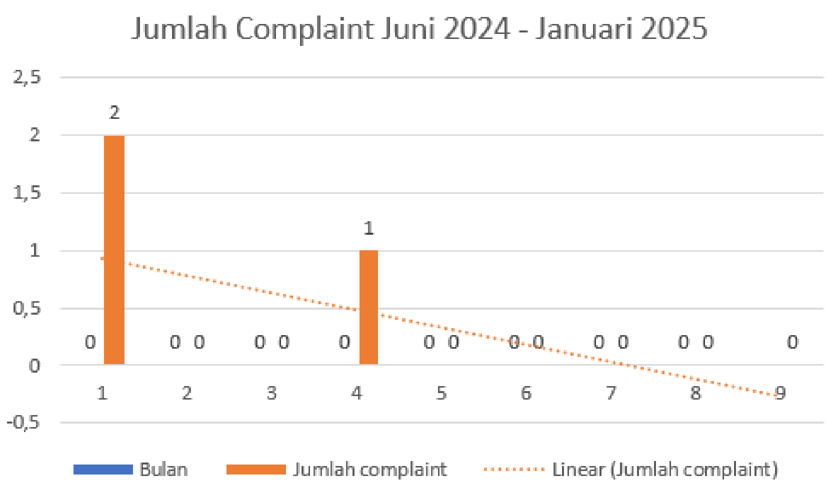

Figure 4. Bar Chart of Complaint Numbers June 2024–January 2025

The results of the cause-and-effect (fishbone) diagram analysis reveal that the increase was correlated with several dominant factors, namely instability in ozone supply, inconsistent paraffin composition, and deviations in temperature and pressure parameters of the laminating machine. Uncontrolled ozone supply reduces the bonding strength between material layers, thereby increasing the likelihood of delamination. In addition, variations in paraffin content exceeding operational standards weaken material adhesion. From the machine perspective, it was found that the actual heating temperature was lower than the established standard, resulting in suboptimal bonding performance. Therefore, the increase beyond the UCL was not random but was triggered by technical factors identified through root cause analysis. This finding demonstrates a direct relationship between statistical process monitoring results and quality analysis findings.

Act (Follow-Up Action)

A quantitative analysis is required for anomaly points that exceed the Upper Control Limit (UCL) by conducting a time-based investigation to identify the specific conditions that occurred during defect spikes. This evaluation may include tracing historical process parameter data, such as fluctuations in temperature, pressure, machine speed, and the stability of ozone supply during the same period. This approach aims to determine whether the anomalies were caused by incidental factors, machine setting errors, material variations, or non-compliance with standard operating procedures (SOPs). In addition, the implementation of a more real-time and digitally documented monitoring system should be considered to minimize delays in detecting process deviations. Re-standardization of the critical parameters that have been improved is also essential to ensure that the corrective actions are sustainable rather than temporary. As a long-term strategic measure, the company may develop a more integrated quality control framework based on data-driven analysis and process risk assessment. In this way, any deviation signals indicated on the control chart will be addressed not only through corrective actions but also through preventive measures supported by a more comprehensive control system.

4. CONCLUSION

Based on customer complaints recorded during the June–September 2024 period and the implementation of PICA (Problem Identification and Corrective Actions) conducted by PT Indofood CBP Sukses Makmur, two dominant causes of delamination were identified: Paraffin droplets dripping onto the film area Insufficient ozone supply. Both factors reduce the bonding strength between the two laminated films, resulting in delamination.

The paraffin droplets are caused by resin vapor that adheres to the extruder hood (resin vapor collector). Over time, the paraffin accumulates on the inner wall of the hood, forming hardened resin deposits. These deposits may eventually drip onto the laminated film surface, causing defects. Meanwhile, the insufficient ozone supply is caused by applicators that have not been properly cleaned. Ozone residue accumulates and forms deposits in the applicator holes, obstructing the ozone flow. As a result, the ozone supply to the film decreases, leading to weak adhesion between the two film layers.

PT IXYZ has implemented the PDCA method through the PICA (Problem Identification and Corrective Actions) system to address delamination complaints. However, delamination complaints have shown a fluctuating pattern, with inconsistent trends of occurrence. For instance, two complaints were recorded in June, none in July and August, and the issue reappeared in September. This fluctuation indicates the need for a more comprehensive reassessment using an appropriate method to identify the root causes of the delamination problem more thoroughly.

The corrective actions implemented include:

- Developing an ozone supply monitoring form
- Creating an OPL (One Point Lesson)

Following these improvements, no delamination complaints were recorded during the October 2024 – January 2025 period, indicating that the corrective measures had a significant positive impact. However, based on the past reject control limit data, the defect rate exceeded the Upper Control Limit (UCL) in December, requiring further monitoring and control measures. In January, the control limit value decreased again.

Therefore, further evaluation, investigation, and continuous improvement are necessary to ensure that the pass-reject rate remains within the established control limits and does not exceed the Upper Control Limit.

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