Identification of Screw Press Machine Malfunctions in PT. Ujong Neubok Dalam (UND) Using Failure Mode and Effect Analysis (FMEA)

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ABSTRACT

PT. Ujong Neubok Dalam (UND) is a company engaged in the business of plantation and processing of palm oil, the processing of palm oil into palm oil is carried out using a screw press. Screw press is a very important machine in processing palm oil into Crude Palm Oil (CPO), if the screw press has problems, then the production process does not run smoothly. This study was conducted to identify damage and repairs to the working tools of the Screw Press machine. In the study using the Failure Mode Effect and Analysis (FMEA) method, which aims to identify risks in advance to take preventive measures. Based on the results of the study, there are 6 risks of failure in the Screw Press machine, with the component that has the highest result, namely the Screw of 108 and the component that has the smallest value, namely the Protection Hut, which is 12. From these results, it can be concluded that the Screw component is a priority or priority in making improvements.

I. Introduction

Indonesia has been named the world's most palm oil selling country. Almost 85% of Indonesia controls the world of palm oil. This oil palm plantation also has the highest role in the country's economy. Palm oil is a plant that produces Crude Palm Oil (CPO), as well as fuel [1].

The intense competition in the industrial world requires companies to maximize their existence to obtain quality and quantity products [2], [3]. To achieve this, the company must be able to detect and minimize the damage that occurs to the machine that interferes with the production process [4].

PT. Ujong Neubok Dalam (UND) is a company engaged in the business of plantation and processing of oil palm fruit, one of these companies is located in Ujong Lamie Village, Nagan Raya Regency, where the production produced is in the form of crude palm oil / CPO (Crude Palm Oil), palm kernel and fibre. The processing of palm fruit into palm oil is carried out using production machines, one of which is a Screw Press machine [5].

Screw Press is a very important tool in palm oil mills, because if this Screw Press is damaged or problematic, then the pressing processing or pressing of Crude Pal Oil (CPO) oil produced becomes less or not optimal and the separation of shells and pulp / fibre is also not optimal [6]. The Screw Press machine consists of 2 mixed iron rods in the form of a spiral (screw) with a horizontal arrangement and rotating in the opposite direction. The crushed palm will be pushed and pressed by the cone on the other side, so that the palm fruit becomes squeezed out [7].

To maintain the quality, condition and effectiveness of the Screw Press machine so that it does not experience damage or at least can reduce the damage time, so that the production process does not stop for too long, a good and proper maintenance and maintenance system is needed for the Screw Press machine so that the results can increase the effectiveness of the machine / equipment and losses caused by machine damage can be avoided.

FMEA is a method that can systematically and structurally analyze and identify the consequences of system and process failures, as well as reduce or analyze the chances of failure [8].

FMEA (Failure Mode and Effect Analysis) is a method used to define, identify, and eliminate defects and problems in the production process both known and potential problems in the system [9]. Risk Priority Number (RPN) is a relationship between three variables, namely Severity, Occurrence (Frequency of Events), Detection which shows the level of risk that leads to corrective action [10].

Previous research by Khrisdamara [11], Failure Mode and Effect Analysis (FMEA) is defined as a structured assessment tool to identify the causes of hazards present in the quality of products and services and the root cause of the problem and as much as possible the emergence of failure mode with its handling steps. Anastasya [12] FMEA is a powerful risk assessment method, which assesses possible risks that may occur in the company's design, production and service measures and can help to reduce or eliminate these risks. The FMEA aims to identify risks in advance to take precautions. Therefore, it is necessary to have this research to obtain how to determine the criteria for Severity, Frequency, and Detection. And can determine the value of the Risk Priority Number (RPN). Risk Priority Number (RPN) is a form of value that will indicate the priorities that must be made improvements to a system so that failures do not occur.

II. RESEARCH METHODS

The object of this study was carried out at the Press station, on the Screw Press machine work tool regarding the identification of damage and repairs to the Screw Press machine work tool. PT. Ujong Neubok Dalam (UND) operates in the Aceh area, Nagan Raya Regency which is an industrial company in the field of palm oil processing. Identified using Failure Mode Effect and Analysis (FMEA). Furthermore, the calculation and data collection are carried out from July 27 to January 27, 2023. The calculation of processed data uses the Microsoft Excel application and is represented in the form of processing results and then generating conclusions.

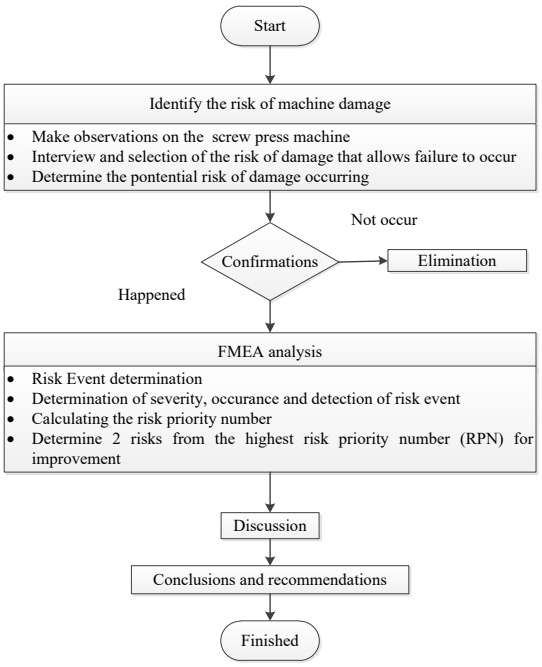

Fig. 1. Flowchart of Research Stages

III. FMEA METHOD DATA ANALYSIS

FMEA is a method used to determine or observe whether a failure rate can be analyzed or measured so that a failure can be anticipated and minimized so that the negative effects of the failure can be controlled [13]. FMEA provides three criteria for each problem that occurs, namely the Severity, Occurrence, and Detection criteria, these three criteria then form a Priority Number (RPN), namely with the formulation SxOxD = RPN, where the higher the RPN, the higher the impact of the problem on the quality of the product or process so that the handler must be moved [14]. According

to Diniaty [15] the definition and scale of Severity, Occurrence, and Detection can be explained as follows:

1. Severity

Severity is a rating that indicates the degree of seriousness of the effects of a failure mode. The criteria for determining the severity value in the following table:

Table 1. *Severity*

Effect	***Criterion***	***Rangking***
Maximum Severity	*Failures that occur inevitably pose a danger*	10
Exterem severity	Failures that occur are likely to pose a hazard, occupational safety must be observed	9
Veryhigh severity	Downtime increases significantly and has an impact on finances, the product cannot be used but is safe, Consumers are very dissatisfied	8
High severity	Downtime increases significantly, Product performance is greatly decreased, Consumers are very dissatisfied	7
Severe	Smooth production is disrupted, Production is running but performance is declining, Consumers are dissatisfied	6
Moderate	Influence seen through the production process Performance will slowly decrease dissatisfied customers	5
Minor	Smooth production is likely to be disrupted Consumers are aware of the small influence on the product	4
Slight	Users may be aware of the influence on the product but the effect is very small (Process and consumer)	3
Very slight	No effect on the smooth running of production has no significant effect on the product	2
None	Realized by the operator is not realized by the consumer	1

2. Occurrence

Occurrence is the possibility that the cause will occur and result in a form of failure during machine use. The criteria for determining the value of Occurence in the following table:

Table 2. *Occurrence*

Occurrence	***Criterion***	***Rangking***
Extremely unlikely	Failure is highly unlikely	1
Remote Likelihood	Possible failures are rare	2
Very low likelihood	Very few failures possible	3
low likelihood	Little possible failures	4
Moderately low likelihood	Moderate probability of failure	5
Medium likelihood	Fairly high probability of failure	6
Moderately High likelihood	High Probability of failure rate	7
High Likelihood	The probability of failure rates is very high	8
Very High likelihood	Failure possible	9
Extremely unlikely	Failure is almost certain	10

3. Detection

Detection is a measurement of the ability to control or control failures that can occur. The criteria for determining the detection value are shown in the following table:

Table 3. Detection

Detection	***Criterion***	***Rangking***
Extremely likely	Control will be required to be aware of defects	1
Very high likelihood	Control is needed to detect failures	2
High likelihood	Control has high effectiveness for detecting	3

Detection	*Criterion*	*Rangking*
Moderately high likelihood	The control has a rather high effectiveness for detecting	4
Medium likelihood	Control has moderate effectiveness for detecting	5
Moderately low likelihood	The control has a rather low effectiveness for detecting	6
Low likelihood	Low probability of detection	7
Very low likelihood	The probability of being detected is very low	8
Remote likelihood	Control has little effect on detecting defects	9
Extremely unlikely	The control will not be able to detect defects	10

IV. Results and Discussion

Risk identification in the Screw Press machine is determined based on the results of interviews with technicians or maintenance supervisors and based on direct observations in the field. Below can be seen the table of Risk Priority Number results on the Screw Press machine.

Table 4. Component damage on the screw press machine

No	*Defective Components*	*Damage*	*Repair Time/year*
1	Screw	Wear	4 kali
2	As	Leaky	4 kali
3	Bearing	Cracking	2 kali
4	Press Cage	Wear	4 kali
5	Protection Hut	Wear	4 kali
6	Gear Box	Cracking	2 kali

Based on the results of the identification carried out, 6 types of damage risks were obtained in the Screw Press machine.

A. Risk of Damage

1. Screw

Headings, or heads, are organizational devices that guide the reader through your paper. There Screw damage is usually caused by wear, due to continuous wearing (not stopping).

2. AS

The damage caused to the screw is caused by the shield as leaking/disintegrating which causes oil to exit through the axle.

3. Bearing

Bearing damage occurs caused by rupture which causes the annual turnover to be carried out 2 times.

4. Press Cage

Damage to the Press Cage is the same as what happens to the screw, which is caused by continuous wear and tear.

5. Protection hut

Protection hut damage is caused by continuous wear and tear which causes repairs to be carried out 4 times / year.

6. Gear box

Gear box that must be repaired 2 times / year, the damage that occurs is caused by rupture of the gear box.

B. Riks Priority Calculation

This calculation is done to find the largest Risk Priority Number (RPN) value of a risk. In calculating RPN first determine the value of Severity, Occurrence and Detection. The following calculations based on existing data can be seen in the table below.

Table 5. The results of the calculation of the FMEA Method RPN

No	Risk	S	O	D	RPN
1	Screw	6	6	3	108
2	As	4	3	1	12
3	Bearing	6	4	4	96
4	Press Cage	6	3	3	54
5	Protection Hut	3	2	2	12
6	Gear Box	5	5	2	50

The following can be seen a graph of the results of the Risk Priority Number (RPN) assessment on the damage to the Screw Press engine components shown in figure 1.

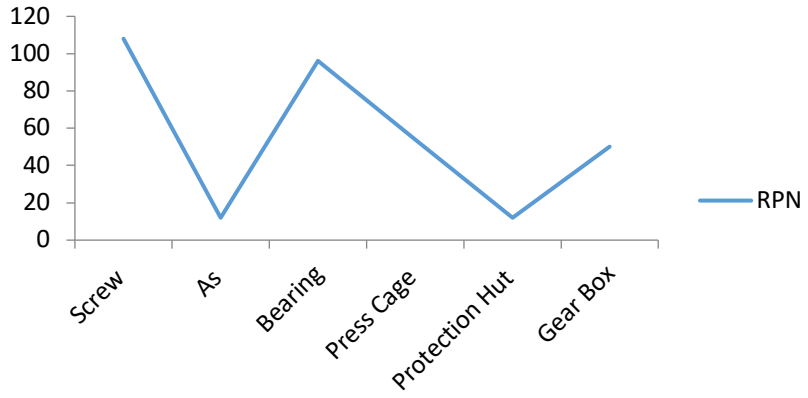

Fig. 2. RPN value on Screw Press machine

Based on the graph above, it can be seen that the highest RPN value is found in the Screw component with an RPN value of 108. While the lowest RPN value is found in the As and Protection Hut components, namely with a value of 12. From this it can be interpreted that the one with the greatest value must be carried out the priority of repairs, and special maintenance must be carried out to prevent the occurrence of damage.

V. Conclusion

Screw Press Machine there are 6 risks of failure that occur based on the results of the Risk Event. Risk Priority Number from the calculation of Severity, Occurrence, and Detection obtained the highest value of RPN in the Screw component with a value of 108. While the lowest value is in the As and Protection Hut components, namely with a value of 12. From these results, it can be concluded that the Screw component is a priority / priority for repair.

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