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Risk Identification on Screw Press Machines Using the Failure Mode and Effect Analysis (FMEA) Method on CV. Rezeki Bersama

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ABSTRACT

CV. Rezeki Bersama is a producer of crude coconut oil (CCO) based in Alus-alus Village, Teupah Selatan District, Simeulue Regency, Aceh. CV. Rezeki Bersama employs 15 people at various production stations, including press machines. In practice, this research uses the Failure Mode and Effect Analysis (FMEA) method to determine the damage that occurred at the press station of the joint rezeki factory. The FMEA approach is used to assess the likelihood of failure in a manufacturing process, determining its severity, frequency of occurrence, and detectability. This study focuses on collecting machine damage data from January 3 to February 3 2024 and evaluating it to determine the Risk Priority Number (RPN) value which will be used to indicate the priority of repairs needed. This research aims to provide recommendations for repair and prevention of damage in the future, as well as increasing the reliability and efficiency of the company's operations

I. Introduction

Competition in industry leads to improvements in equipment that can increase production speed and improve quality and productivity. A very important line in a company. The productivity of several items on the production line must always be increased, including equipment and machines that help the production process. Improving machine performance in the coconut processing industry is very important in optimizing production activities in order to achieve good final results and increase company productivity. To improve machine performance, it is necessary to carry out proper maintenance on the machine during the production process to prevent damage or that could affect the final product. Efforts to improve the production environment, both equipment and machines, are aimed at making the best use of existing equipment. In the average industrial industry, existing equipment is used at half the capacity of the actual machine [1]. The process of making CCO (crude coconut oil) at CV.Rezeki Bersama is continuous or sustainable. Production capacity can reach 1 ton per day. The activities carried out in the workplace are very long and complex so there is a risk of stopping the production process [2]. Proper engine maintenance involves the correct method of investigating why the engine is performing poorly. The Failure Modes and Effects Analysis (FMEA) technique is one of several methods that can be used to mitigate problems encountered during the production process. Failure Mode and Effect Analysis (FMEA) is a systematic technique that can be used to identify product or process problems before they occur. FMEA focuses on preventing errors, improving security, and increasing customer satisfaction. Ideally, FMEA is applied at the product design or process development stage. [3].

II. The Proposed Method

This investigation was carried out from January to February 2024 at the CV Coconut Factory. Shared Sustenance in Babah Dua Village, Tadu Raya District, Nagan Raya Regency, Aceh. The research focused on identifying damage to the coconut factory pressing station at the Rezeki Bersama factory to determine the order of the RPN (Risk Priority Number) values from highest to lowest. The highest RPN value can be interpreted as meaning that the component requires immediate treatment [4]. The author made direct observations and discussions with press machine operators to determine the damage that occurred in the field. Maintenance work on company machines and equipment requires appropriate internal methods and procedures [5].

III. Method

The advantage of FMEA is that risk can be analyzed and calculated based on the risk of failure and the consequences of failure, what events may occur in the production process, and the range of potential failures [6]. Failure Mode and Effects Analysis (FMEA) is a cycle risk analysis technique that determines how equipment, facilities/systems will fail and what the consequences will be [7].

a. Tages in fmea (failure mode and effects analysis)
- Identify types of possible failures in equipment
- Identify the cause of each possible problem that occurs
- Determine the implications of failure
- Identify control failures
- Identify factors that cause defective products with the highest Risk Priority Number (RPN) and prioritize repair efforts

b. Determination of interference
- Level of Damage (Severity), In determining the extent of damage (severity), it can be determined how severe the damage caused by process failures in terms of maintenance operations and company operational activities.
- Frequency (event), this event can be known by calculating how many disturbances can cause failure in maintenance operations and manufacturing operational activities.
- Detection Rate To determine the detection rate, consider how failures can be recognized before they occur [8].

c. Stages of creating FMEA
- Establishment of potential failure modes (type, effects, causes and controls). The potential failure effect is the impact that a failure has on consumers.
- Determining the severity value (S) severity is a warning that indicates the seriousness of the effects of a failure mode. Criteria for determining the severity value on. Table 1 shows the criteria for assigning severity grades [9].

Table 1. Calculation of Savings Value

Effect	Criteria	Rank
Maximum severity	Any failure that occurs will definitely cause danger	10
Extreme severity	Failure that occurs may cause danger, work safety must be considered	9
Very high severity	Downtime increases significantly and has an impact on finances, products cannot be used but are safe, consumers are very dissatisfied	8
High severity	Downtime has increased significantly, product performance has greatly decreased, consumers are very dissatisfied	7
severe	The smoothness of production depends, production is running but performance is decreasing, consumers are very dissatisfied	6
moderate	The effect seen through the production process performance will slowly decrease as customers become dissatisfied	5
mirror	The smoothness of production may be disrupted by consumers realizing the small impact on the product	4
slight	Users may be aware of the impact on the product but the impact is very small (process and consumer)	3
Very slight	Has no effect on smooth production, has no significant effect on the product	2
None	The operator is aware of it, but the consumer is not aware of it	1

Determine the value of Occurrence (O), Occurrence is the possible cause and result in some form of failure when using the machine. Criteria for determining Event values.

Table 2. Calculation of occurrence

Occurrence	Criteria	Rank
Extremely unlikely	Failure is highly unlikely	1
Remote Likelihood	The possibility of failure is rare	2
Very low likelihood	Very few failures are possible	3
low likelihood	Few failures are possible	4
Moderately low likelihood	Medium probability of failure	5
Medium likelihood	The probability of failure is quite high	6
Moderately High likelihood	High probability of failure rate	7
High Likelihood	The probability of failure is very high	8
Very High likelihood	Failure possible	9
Extremely unlikely	Failure is almost certain	10

- Calculating the detection value (D), determining the detection level involves identifying the process controls that will clearly (specifically) detect the cause of the failure or damage. Detection is a measurement of the ability to control or control failures that can occur [10]. The criteria for determining the Detection value are shown in Table 3.

Table 3. Determination of value detection

Detection	Criteria	Rank
Extremely likely	Controls will be required to become aware of defects	1
Very high likelihood	Control is very necessary to detect failure	2
High likelihood	Controls have high effectiveness for detection	3
Moderately high likelihood	Control has a fairly high effectiveness for detecting	4
Medium likelihood	The control has moderate effectiveness for detection	5
Moderately low likelihood	The control has rather low effectiveness for detection	6
Low likelihood	The probability of detection is low	7
Very low likelihood	The probability of detection is very low	8
Remote likelihood	Controls have little influence on detecting defects	9
Extremely unlikely	Controls will not be able to detect defects	10

• Calculating the Risk Priority Number (RPN) value, the Risk Priority Number is a type of value that indicates the priority that must be given to improving a system to prevent failure. The RPN value is calculated using the formula below

RPN = Severity x Occurrence x Detection.
Description:

Severity : Potential causes of failure were obtained from interview data
Occurrence : The effect of failure is obtained from interview data
Detection : Controlling failure using interview data

IV. Results and Discussion

Data collection techniques are carried out by:

- Observation is a data collection method that is carried out by conducting field research (directly) and observing the things being researched to obtain the relevant data.Mewawancarai, atau mengajukan beberapa pertanyaan kepada karyawan perusahaan untuk mengumpulkan informasi yang lebih terkini dan benar.
- Literature Review, namely looking for various supporting theories in books and journals/articles that are related to the problem being discussed.
- Data corruption and repair time

A. Screw Press Machine Damage and Repair Time Data Damage to the press station and repair time for damaged components are presented in Table 4.

Table 4. Damage and repair time at press stations

No	Damaged Components	Damage	Repair time	Information
1	Sorong Screw	Wear/erosion	2 hours	Repaired/not immediately replaced
2	Screw Press	Wear/crack, eroded	2 hours	Repaired/not immediately replaced
3	Setting / Lock	Wear/longer	1 hour	Fixed
4	Ace of Iron	Broken	24 hours	Replaced with a new unit
5	Abdominal Press	wear and tear	1 hour	Fixed
6	Iron Knife	Broken, worn	2 hours	Repaired/not immediately replaced
7	Mangkok Press	Wear and tear	1 hour	Repaired/not immediately replaced
8	Lava	Eroded wear cannot rotate optimally	1 hour	Replaced with a new unit
9	Bolt	Wear/looseness	1 hour	Replaced with a new unit
10	Base Motor	V-Belt Broken/Loose, Scorched	4 hours	Repaired/replaced with a new unit

B. Screw Press Machine Damage Data

The screw press machine is repaired every Saturday, first on January 6 and January 7 2024, so the damage that occurs to the screw press machine components is shown in Table 5.

Table 5. Data on components and damage to press station components

No	Screw Press Machine Parts Components	Damage
1	Sorong Screw	Wear/erosion
2	Screw Press	Wear/crack, eroded
3	Settings / Lock	Wear/longer
4	Ace of Iron	Broken
5	Abdominal Press	wear and tear
6	Iron Knife	Broken, worn
7	Mangkok Press	Wear and tear
8	Lava	Eroded wear cannot rotate optimally
9	Bolt	Wear/looseness
10	Base Motor	V-Belt Broken/Loose, Scorched

C. Calculation of risk priority numbers (RPN)

Risk Priority Number is a value that represents the severity of the impact of failure (Severity), frequency (Occurrence), and level of detection (Detection) based on interviews and brainstorming. One example of the calculation is for screw press components.

Known:
S = 6
O = 6
D = 3

Solution:
RPN = S x O x D
= 6 x 6 x 3 = 108

So the RPN value for the screw press component is 108. The Risk Priority Number value for damage to the press station component is in Table 6

Table 6**.** Calculation of Risk Priority Number (RPN)

No	Screw Press Machine Parts Components	S	O	D	RPN
1	Sorong Screw	6	6	3	108
2	Screw Press	6	8	3	144
3	Settings / Lock	3	2	3	18
4	Ace of Iron	7	8	3	168
5	Abdominal Press	2	1	3	6
6	Iron Knife	4	5	3	60
7	Mangkok Press	7	7	3	147
8	Lava	1	5	3	15
9	Bolt	1	4	3	12
10	Base Motor	1	5	3	15

Tabel 7. Recapitulation Results of Failure Mode and Effect Analysis (FMEA) Assessment

No	Screw Press Machine Parts Components	Damage	Potential Causes of Failure	Determining the Effects Caused by Failure	Identify Control Failures	S	O	D	RPN
1	Sorong Screw	Wear and tear/	Rotation effect on the iron knife inside the stomach press	Cannot rotate optimally	Carry out regular machine maintenance and check the Sorong Screw	6	6	3	108
2	Screw Press	eroded	The effect of rotation on the press bowl and iron knife	Cannot rotate so pressing cannot be done	Carry out regular machine maintenance	6	8	3	144
3	Settings / Lock	Wear and tear/	The result of locking too tight	Pressing is not optimal	Carry out machine maintenance regularly to see the quality of the press	3	2	3	18
4	Ace of Iron	cracked, eroded	The result of locking too tight	Cannot push/hold the cake so it cannot be pressed	Carry out regular machine maintenance on iron axles	7	8	3	168
5	Abdominal Press	Wear and tear/	The effect of the iron knife	The effect of a knife that has started to wear out	Carry out regular machine maintenance	2	1	3	6
6	Iron Knife	Broken,	Due to the rotation of the screw press and thrust	Cake cake is unstable so erosion often occurs	Carry out regular machine maintenance on the knife	4	5	3	60
7	Mangkok Press	wear and tear	Effect of screw press pressure	As a result of being too tight when locking, wear occurs quickly	Carry out regular machine maintenance, look at the rotation of the screw press and thrust	7	7	3	147
8	Lava	Wear and tear	Bearing age and load are too large	Cannot rotate so pressing cannot be carried out	Carry out regular machine maintenance and check the lava	1	5	3	15
9	Bolt	Eroded wear cannot rotate optimally	Frequently tightened and loosened	Effects resulting from locks/settings	Carry out regular machine maintenance and check the bolts	1	4	3	12
10	Base Motor	Wear and tear/	The V-Belt is fragile due to heat	The machine is dead, the pressing cannot be carried out	Carry out regular machine maintenance, monitor rotation	1	5	3	15

V. CONCLUSION

The conclusions obtained from the results of the practical work report at CV. Shared Sustenance as follows Severity, Occurrence and Detection assessment of the 10 components/parts that experienced problems. The highest level of Severity was found in the iron axle component/part and press bowl with a value of 7, the highest occurrence assessment was in the iron axle component/part with a value of 8 and the Detection assessment has the same value for each component/part with a value of 3. The Risk Priority Number from the Severity, Occurance and Detection calculations obtained the highest value for the component/part of the iron shaft with a value of 168, while the lowest Risk Priority Number value is found for the component /part stomach Press with a value of 6.

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