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Impact of welding steel rod rotor bars on ripple mill efficiency and cost-effectiveness at Sumatera Jaya Agro Lestari Sawit Coconut Plant

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Abstract

PT. Sumatera Jaya Agro Lestari is an industry that is moving in the field of coke processing, some long processes that include loading ramp, sterilizer, thresher, digester, pressing, clarification, and kernel plant stations, some problems that occur in the kernel stations mainly to efficiency results on the ripple mill machine, not out of the operation and maintenance standards performed by using the achievement of the target of the kernel by the efficiency standard of 96%, on ripple mill machines often occur cwornouteson steel rod due to the input of the ripple mill too over load, and the amount of nut less mature, for that was done a study on steel rod that has already worn out by performing the re-welding method, i.e. the addition of the meat of the steel rod to 5 mm of the surface of the rotor-disc to obtain the maximum effectiveness result. The steel rod is the most important part of the mill ripple machine consisting of stone mills that move automatically so that it will not reach the maximum efficiency result at mill mills ripple rod. With the welding method, the surface of the welded meat is applied to a steel rod with a thickness of 5mm to 7mm using the MWH 500 type electrode to form the return of the base of the new steel rod surface where the strength of the electrodes and the formation of the surface are correct. The results can be inferred from the efficiency of the impact of welding steel rod averages 93.38% achieving a very high efficiency.

Keywords:
Efficiency, ripple mill, welding.

1 Introduction

PT.Sumatera Jaya Agro Lestari is an industry that is engaged in palm coconut processing, a process that involves ramp loading stations, sterilizers, dryers, digesters, pressing, clarification, and kernel plants. In the kernel station, some difficulties are primarily related to the ripple mill machine's efficiency, not due to the operating standards and maintenance carried out to meet the 96% efficiency standard. As a result of the excessive input feed from the ripple mill machine, as well as the lack of ripe nuts, there is often a loss of steel rod in the ripple mill machine. To achieve maximum efficiency, it is necessary to study the steel rods that are already available by re-welding them, i.e. adding meat to 5 mm of the rotor disc surface to achieve maximum efficiency[1-5].

The research should be conducted using three different sizes of palm coconut seeds with three repetitions for each treatment. Processing of the seeds in the palm coconut plant is a very important procedure for the success of the core processing. In palm coconut factories, ripple mills are used to break down seeds[2][6][7].

The ripple mill is a device that breaks seeds by allowing the seeds to enter the rotating rotor bar of a rotating rotor. This mechanism consists of pressing the seed with a rotary bar on a barbed wall to it to break. Seed-breaking efficiency is influenced by the speed of the rotor bar, the distance between the rotor bar and the barbed plate, and the sharpness of the plates that act as holders and breakers. In palm coconut factories, ripple mills are used to break nuts so that the kernel can be removed from the nut shell[8]. The seeds are embedded between the rotor bar and the square bar, cworn outing the shell of the core to be broken by collision [9-13].

Ripple mill machines have several advantages, including the ability to break up wet seeds from a nut polishing drum instantly without the need for drying through the nut silo, heater, and fan, so that electricity consumption and maintenance costs for additional equipment can be minimized, as well as steam savings, which can be utilized for stations with a need for steam, such as fruit repayment stations. The seed melting efficiency of the process reaches 98%, which reduces the losses associated with unresolved seeds at the end of the clay bath and hydro cyclone processes [3,4][15][16].

1.1 Rotor As

The rotor axis serves as the focus of the load applied to the other components of a rotor. As a result of the rotation of the rotor axis, the rotor axis rotates; it is the motor that transmits its rotation to the rotor axis through the pins and belts (Fig. 1).

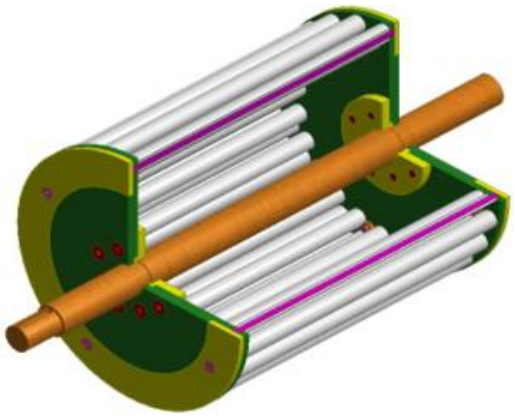

Fig. 1. Rotor As (source: PT. Sumatera Jaya Agro Lestari).

1.2 Rotor Disc

The rotor disc is one of the components of a rotor bar that determines the position of the bar (Fig. 2).

Fig. 2. Rotor disc(source: PT. Sumber Jaya Agro Lestari).

1.3 Rotor Bar

Rotor bars are pile-shaped axes around rotors used to place palm seeds in ripple mills. Rotor bars are pile-shaped axes around rotors used to place palm seeds in ripple mills (Fig. 3).

Fig. 3. Rotor bar (source: PT. Sumatera Jaya Agro Lestari).

1.4 Ripple Plate

The ripple plate is commonly referred to as the seed breaker wall. As seeds are carried by the rotor, they will be thrown under pressure against this wall, cworn outing them to break apart.The ripple plate is fitted to the walls of the container to create pressure on the seeds[17][18] (Fig. 4).

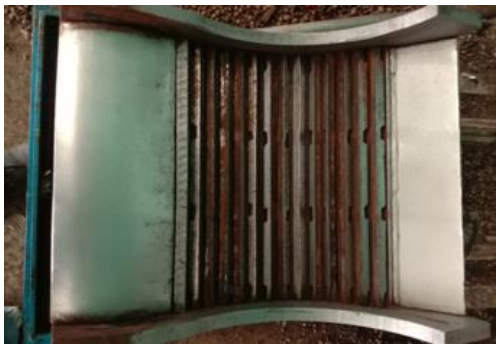

Fig. 4. Ripple plate (sumber : PT. Sumatera Jaya Agro Lestari).

2 Research Methodology

2.1 Sampling

In the operation of the ripple mill that passed the recommended service life of the manufacturer. Therefore, there is a need for rigor to be able to analyze, select and use effective tools in the process to find optimal processing costs with good performance so that it can be a good input to the palm coconut plant. The method used to obtain research data is to take samples 1 and 2 by taking 1 kg of kernel nut. 1 kg is one sample placed on the kernel nut filling with a note that should not be too much resulting in the steel rod suffering depletion so that the square bar is dull and the rotor bar is bent overwhelming the breakage ineffective (Fig. 5).

After sampling and weighing the samples taken from the ripple mill by 1kg, after weighting as much as 1kg will separate the type of sample to be chosen there are several types of samples names Cb (gram), whole kernel (Wk), broken kernel (Bk), whole nut (Wn), broke nut (Bn), efficiency (%).Calculation % as shown in Eq. 1(source: PT. Sumatera Jaya Agro Lestari).

$$\text{Cb} = \text{Wn}: \text{C} = \% \quad (1)$$

Fig. 5. Samples before welding.

2.2 The Procedure to Repair Steel Rod

Before repairing the steel rod, make sure that the material to be repaired is clean of dirt to get the maximum grinding (Fig. 6).Welding wire used type MWH 500 with a weight of 5 kg. Prepare a steel rod that will be welded on the outer part of 22 bars and then use a caliper to measure the addition of welded meat on a steel rod with a thickness of 5 mm to 7 mm.

The distance between the ends of the electrode and the steel rod at a distance of 3 mm from the welded wire bow to the material to be welded greatly affects the welding quality. When the distance is so far, there will be sparks like the rain of flame spots. The process of welding is not perfect. When it is so close, the fire does not ignite perfectly. And there's not enough distance for the electrode leakage. A good distance is an eighth of the thickness of the electrode.

The addition of welded meat or welding steel rod is carried out with the aim of re-fitting a surface that is already worn out, the standard condition equipment is as close as possible to the original condition that is comfortable with the physical condition,theusability extends the service life and saves the duration of usage. The parts of the components of the welded meat or welding steel rod that occur in the abrasion range of 3 mm.

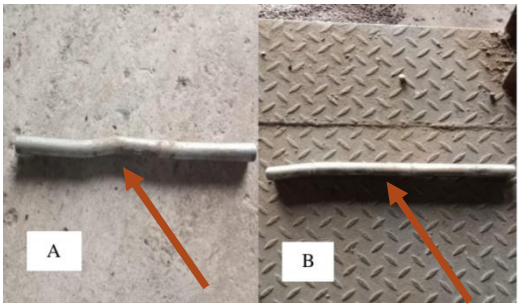

Fig. 6. Steel rod (source: PT. Sumatera Jaya Agro Lestari).

3 Results and Discussion

As for the repair of the welding result of the steel rod that is to be performed with welding technique or the addition of welded meat with a thickness of 5mm to 7mm that is performed on the surface of the top steel rods, due to depletion by using an electric welding travo machine, the type of electrode MWH 500 to form the return of the base of the surface steel rod that is already worn out where the strength and strength of the electrodes is balanced and the formation of the proper surface (Fig. 7).

The addition of welded meat or welding steel rod is carried out with the aim of re-fitting a surface that is already worn out, the standard condition equipment is as close as possible to the original condition that is comfortable with the physical condition, the usability extends the service life and saves the duration of usage. The parts of the components of the welded meat or welding steel rod that occur in the abrasion range of 3 mm (Fig. 8).

After sampling and weighing the weight of the sample taken from the ripple mill as much as 1 kg, for1kg will do separation of the type of sample to be selected and there are several types of samples named whole nut (Wn) and broken nut (Bn).

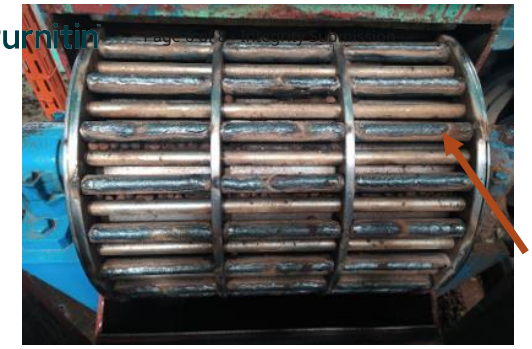

Fig. 7. Addition of welded meat with a thickness of 5mm–7mm.

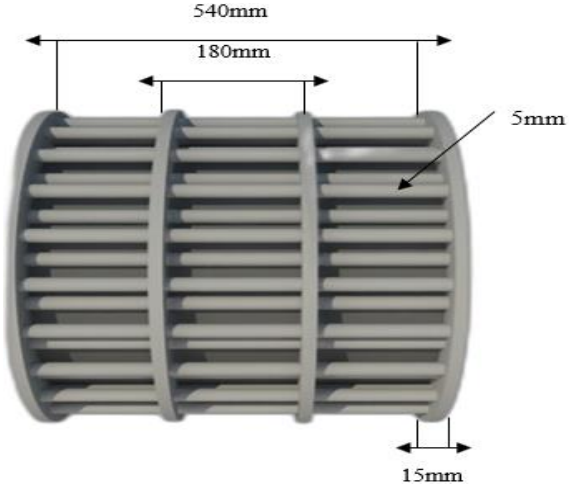

Fig. 8. The steel rod that has been welded.

3.1 Stell Rod Ripple Mill Welding Efficiency Results Achieving Maximum

After seeing the results of the research analysis of the impact of welding steel rods ripple mill obtained maximum results after welding or the addition of welded meat on the surface of the steel rod and obtained the efficiency that has been applied to the company and the names of samples Cb (gram), whole kernel (Wk), broken kernel (Bk), whole nut (Wn), broken nut (Bn), efficiency (%)[19] (Fig. 9).

After looking at the results of the analysis of the impact of welding steel rods with steel rods that are already worn out looks very far compared to that is already in welding. The results of sample 1 and sample 2 efficiency steel rod that have worn out ripple mill that is not achieved maximum as shown in Table 1 and Table 2.

Table 1. Sample 1 is worn out

Sample product	Weight sample	Efficiency
Cb	1051.8 kg	%
Wn	20.1 g	1.95
Bn	106.7 g	8.73
Eff. RM		89.32

Table 2. Sample 2 is worn out

Sample product	Weight sample	Efficiency
Cb	1051.3 kg	%
Wn	15. 6 g	1.48
Bn	89.7 g	10.14
Eff. RM		88.38

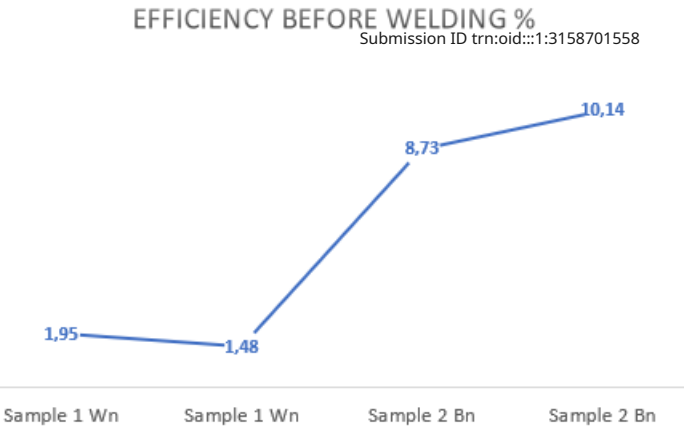

Fig. 9. Efficiency before welding steel rod.

3.1.1 Weighing Samples that have been Welded

After sampling and weighing the weight of the sample taken from the ripple mill of 1 kg, after weighed as much as 1 kg will do the separation of the type of sample to be selected as shown in Table 3-4 and Fig. 10-11.

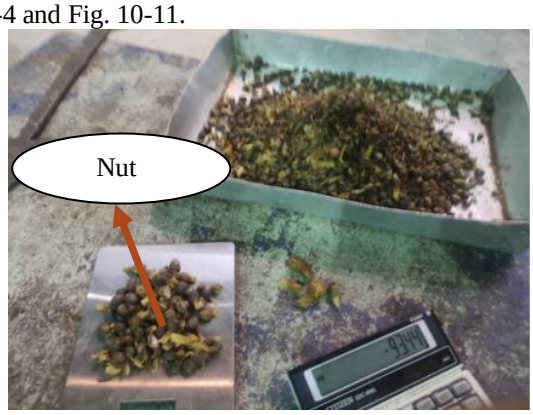

Fig. 10. Weighing samples that have already been welded.

Table 3. Sample 1 already in welding

Sample product	Weight sample	Efficiency
Cb	1051.6 kg	%
Wn	9.4 g	0.89
Bn	53.6 g	5.09
Eff.RM		94.02

Table 4. Sample 2 is already in welding

Sample product	Weight sample	Efficiency
Cb	1033.4 kg	%
Wn	12.8 g	1.23
Bn	54.7 g	5.29
Eff.RM		93.48

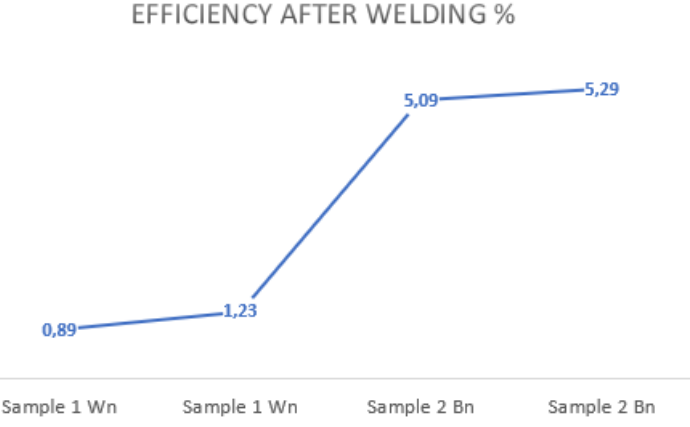

Fig. 11. Graph of efficiency after welding steel rod.

3.1.2 Results of the Welding Steel Rod Impact Analysis

The analysis of the impact of welding steel rods is more efficient than the steel rod that has been worn-out and the results

of the research are superior, average value of 93.38%. The result of welding efficiency can be seen in Fig. 12.

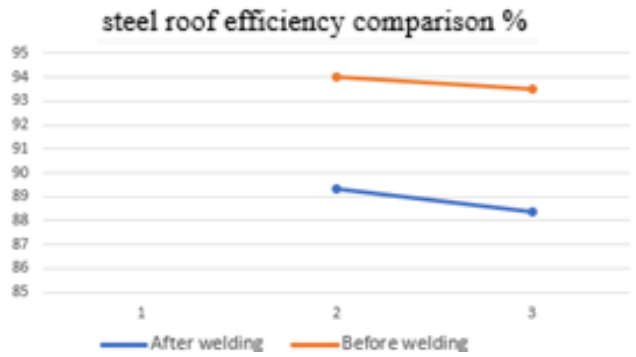

Fig. 12. Comparison of efficiency before and after welding.

3.2 Operational Costs of Welding Steel Rood

Accordingly, the difference or price comparison between the new steel rod and the steel rod that is already in welding could be the basis of the company's cost savings analysis (Table 5–Table 8).

Table 5. Components for the repair of steel roofs

Material	Size l and P	Cost per piece
Steel rod 44	25 - 20 mm and 540 mm	Rp. 4,400,000
Total		Rp. 4,400,000

Table 6. Welding wire price (electrode MWH 500)

Material	Size	Cost
Electrode MWH 500	4 mm, 250 mm	1 kg Rp. 1,200,000
Electrode MWH 500	4 mm, 250 mm	3.5 kg Rp. 420,000
Electrode MWH 500	4 mm, 250 mm	5 kg Rp. 600,000
Total		Rp. 1,140,000

Table 7. Staff salaries for repair work steel rood

Material	Amount	Cost
Salary of staff	1 person	Rp. 170,000
Food	1 person	Rp. 50,000
Total		Rp. 220,000

Tabel 8. The cost of installing a new steel rood

Material	Cost
Steel rod	Rp. 4.400.000
Salary for staff and electrode MWH 500 5kg	Rp. 820.000
Total	Rp. 5.220.000

There is a significant price difference between the price of welded steel rod and the price of new steel rod. It can save the cost of the company in PT. Sumatera Jaya Agro Lestarisustainable with the range of Rp. 3,580,000. The new price of steel rods is Rp. 4,400,000, the price for welding or welding wire, and the salary of the employee is Rp. 820,000.

From the results of all the tables (Table 5–Table 8), the policy on reuse and repair of steel rods that have suffered damage can give a huge profit to the company and get the maximum efficiency of the ripple mill after that saves the company's cost in PT. Sumatera Jaya Agro Lestari.

4 Conclusion

Based on the data collection and analysis on the reuse process of steel rods which have been worn out with the method of welding or the addition of welded meat on the surface of the steel rod at PT. Sumatera Jaya Agro Lestari Palm Oil Mill Tayan Kalimantan West, it can be concluded that the results of the welding against the steel rood ripple mill process can increase the efficiency of the kernel to 95% and obtain maximum results according to those applied in PT. Sumatera Jaya Agro Lestari.

The entire company's cost savings policy against the recovery and repair of damaged steel rods can give a huge profit to the company. And get the maximum efficiency ripple mill results after that saves the company's cost in PT. Sumatera Jaya Agro Lestari.

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