

Usefulness Assessment of Powder Seasoning Packing Machine Based on the Overall Effectiveness Equipment Approach

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ABSTRACT

Machine and equipment is the main factor that supports the smooth running of activity in a manufacturing company. PT ZA is a large-scale instant noodle producer in Indonesia. The quality division has implemented periodic maintenance management. However, the packing machine shutdown has resulted in a delay in meeting the production target for the seasoning powder packaging. This problem results in a delay in the work in process. This study aims to evaluate the effectiveness of the seasoning powder packing machine using the Overall Effectiveness Equipment (OEE) approach. The research object is the FPD 93 packing machine and production data from the Quality Division. The results of this study show that the OEE score of the packing machine is 67 %. The effectiveness of the packing machine is lower than the world standard OEE value of 85 %. Availability and performance factors are two factors that result in low OEE values. Furthermore, the two factors must be improved so that OEE values meet world-class standards.

Key words: OEE, packing, powder, availability, performance, quality

1. INTRODUCTION

In the manufacturing industry, machinery and equipment are production supports which are one of the company's main strengths in the continuity of the production process. Good quality product is based on competent workers, suitable raw materials, excellent machine performance, and the right system and method. [1]. Furthermore, the automatic manufacturing process depends on the accuracy and readiness of machines and equipment [2], [3]. The specification of machines and equipment will be subjected to a decrease in their ability to carry out their duties as they age. A problem in both internal and external factors affects the machine's ability and performance [4]. As a result, the delay in the production process affects meeting the output production targets.

PT ZA is a prominent enterprise that produces good-quality instant noodles. The company implements an effective food safety management system and prioritizes customer satisfaction. The instant noodle production line is divided into two: the noodle and the seasoning. The seasoning Division is the process of producing instant noodle seasonings and seasoning packaging. Spice Packing is the process of packaging seasoning powder carried out by the operator using seasoning packing machines. In the seasoning packing process, the operator inputs the powder into the machine hopper and starts the production process. The operator collects the product packing results to the release table for quality control—the quality control signs the powder release seasoning packing using a green marker. The checker sends it to the warehouse storage. The Quality Control The results of the documentation of the production target report, product loss, and damage to the spice powder packing machine indicate downtime losses in the spice powder packing machine. Three seasoning powder machines, namely FPD 16, FPD 13, and FPD 93 A D. Table 1 represent Production data in the packaging section from July to August 2021.

Table 1. Production results from June to August 2021

Month	Production results (pcs)	Production targets (pcs)	Product defects (pcs)
June	886,951	990,000	6125
July	955,106	990,000	6070
August	913.188	990,000	6646

It can be seen in Table 1. that the output production of the FPD 93 machine is the lowest OEE is used to analyze machine effectiveness [5]. OEE implementation can obtain a measurement of performance related to the availability of process productivity and Quality [6], [7]. OEE measurement shows how well the company uses its resources, including equipment, workers, and the ability to satisfy consumers in terms of delivery according to quality specifications according to consumers. The success of OEE implementation is the continuous improvement of each equipment and work process. The results of OEE implementation in Indonesian firms show an OEE score of around 40% - 60% or 50% - 75%. This score means local companies can still increase capacity and productivity by around 25% - to 100 [4], [8], [9].

This study aims to evaluate the powder seasoning packing machine's availability, performance, and quality based on the effectiveness of the OEE approach. OEE is proven to increase the manufacturing process's efficiency [8]. OEE can detect sources of lost manufacturing productivity using three categories as a matrix that measures the excellence of manufacturing operations. [2], [5], [10]. The results of OEE measurement can be used as consideration for decisions in purchasing new equipment to meet customer demand [11].

2. METHODS

Study design, sample, and procedure

This study uses a descriptive quantitative approach. The data used was based on the historical data of the packing section. Furthermore, the packaging production section data were collected from June 2021 to August 2021. This research procedure began with a walk-through survey and continued with primary data collection. The primary data collected was the amount of production, production time, cycle time, production output, product defect, total product output, working day, and output production target. The data was obtained from the Quality Control division.

Data analysis techniques

The OEE calculation stage begins with calculating the availability, performance, and quality scores presented in Formula 1.

$$OEE = Availability \times Performance \times Quality \tag{1}$$

Availability also accounts for *downtime loss*, namely the loss of production time due to machine downtime or work processes. Operating time is the result of working time minus planned and unplanned downtime. Loading time is generated by reducing working time minus planned downtime. The availability time can be seen in formula 2.

$$Availability = \frac{operation\ time}{planned\ production\ time} \tag{2}$$

The performance considers factors that cause the process to operate slower than the maximum possible speed while the process is running. Performance d is calculated according to formula 3.

$$Performance = \frac{\left(\frac{total\ output\ production}{operating\ time}\right)}{ideal\ run\ time} \tag{3}$$

Quality is a part or parts that do not meet the quality requirements. Formula 4 is a way of calculating Quality.

$$Quality = good\ products \frac{good\ product}{total\ output\ product} \quad (4)$$

3. RESULTS AND DISCUSSION

Data is needed before operating the OEE calculation, which can be seen in Table 2. The data collected was the number of shifts and working days, total availability time, planned and unplanned downtime, loading time, and output production.

Table 2. Working hours, total availability time, planned and unplanned downtime, Output Production

Month	Number of days	Shift /day	Work hours / shift	Total Availability Time (Minutes)	Total Planned Downtime (minutes)	Unplanned downtime (minutes)	Loading time (minutes)	Producti on output (pcs)
June	30	3	8	43200	5400	3540	37800	886951
July	31	3	8	44640	5580	3420	39060	955106
August	31	3	8	44640	5580	2950	39060	913188

Calculation Results of Availability, Performance, Quality, and OEE

The availability calculation is a ratio that describes the utilization of the available time for machine or equipment operation activities. The results of the availability calculation can be seen in Figure 1. The availability calculation is by Formula 2.

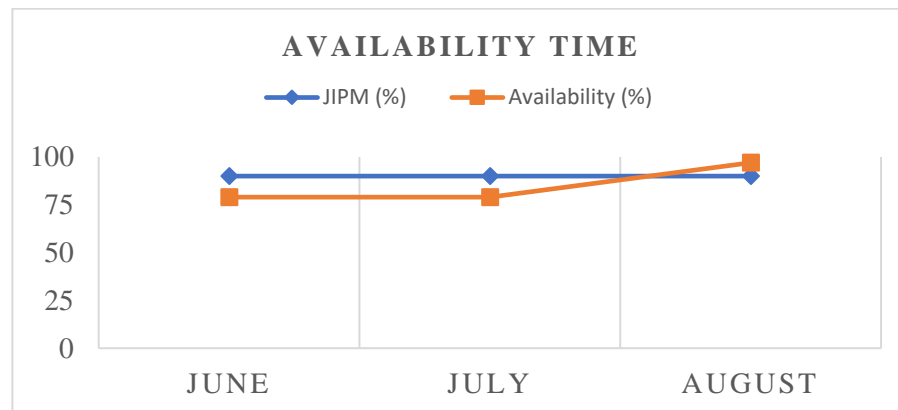


Figure 1 Availability Time

It can be seen from Figure 1. that the availability time value in June and July is 79 percent and has increased to 97 percent in August 2021. The availability time value in the first two months is below the JIPM availability standard of 90 percent. Performance Factor Is a ratio that describes the ability of the equipment to produce products. *Performance* factor calculations and calculations using the JIPM standard can be seen in Figure 2.

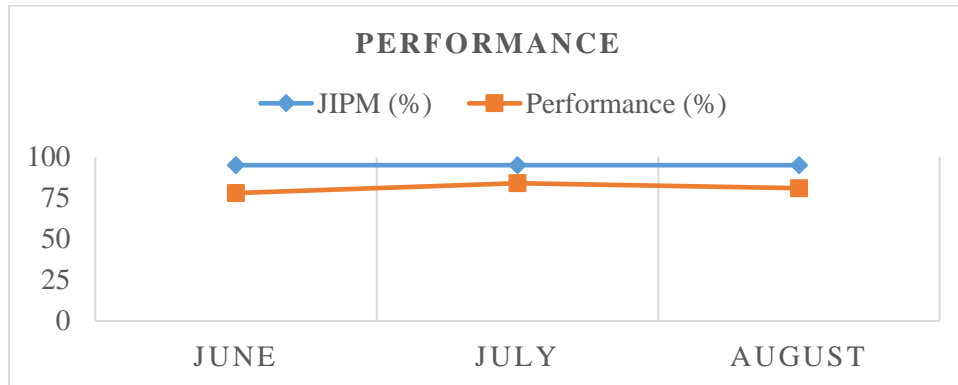


Figure 2. Performance

JIPM standardizes a score of 95 percent according to the results of performance in international companies. The performance value of the seasoning powder packing machine in June – August was 78 percent, 84 percent, and 81 percent, respectively, according to Figure 1. The results of the machine's performance for three months were below the JIPM standard value. Figure 3 is the result of a comparison of the Quality of the packing machine and the JIPM standard.

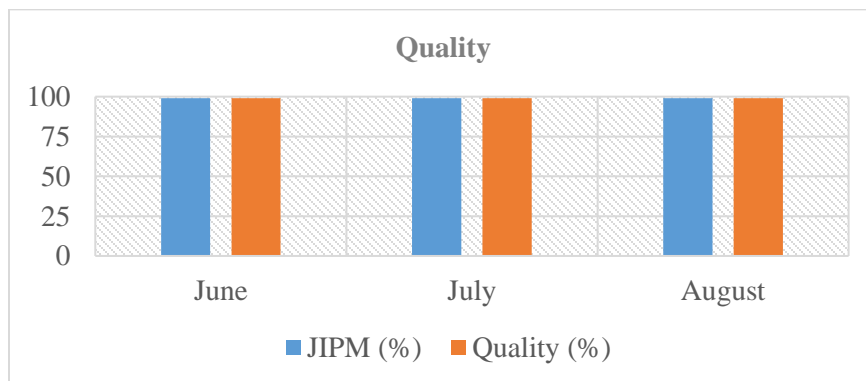


Figure 3. Quality

The quality factor is a ratio that describes the equipment's ability to produce products according to the standard. Formula 4 is used to calculate the quality results. Figure 3. illustrates the comparison between the Quality of the packing machine and the JIPM quality standard. The results of the quality calculation are 99 percent. The packing machine quality score is the same as the standard JIPM, 99 percent. Calculating the Availability, Performance, and Quality Value is the step in calculating the OEE value. The calculation of OEE value is calculated based on Formula 1. Then multiply the three factors. The OEE performance value is compared by comparing the calculated results of the measured OEE value with world-class OEE value standards. An OEE value less than the world-class OEE value standard of 85 percent is concluded that corrective action must be taken. In contrast, an OEE value that is more than or equal to the world-class OEE value standard is concluded that it has met the standard. Figure 4 is the result of the OEE calculation.

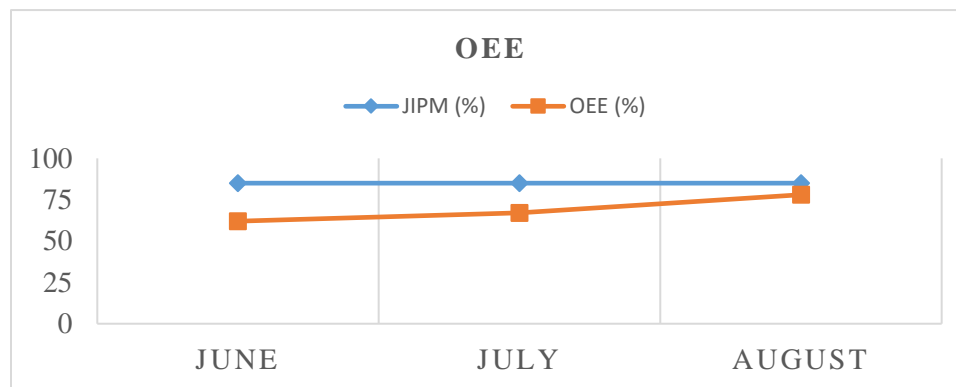


Figure 4. OEE value

Discussion

The OEE performance results showed that the seasoning powder packing process did not meet the world-class OEE standard of 85%. The values were 62 percent, 67 percent, and 71 percent. The two OEE factors did not meet the standards: the Availability factor with a value of 80%, and the Performance factor with an average value of 81 percent. The OEE value of the seasoning powder packing process for that period was below the world-class OEE value standard. The achievement of low OEE performance values in spice powder packing is caused by two factors: availability and performance. The average performance value is around 67 percent and below the world-class OEE standard of 85 percent. Corrective action is needed in order to increase the effectiveness of the FPD 93 packing machine.

4. CONCLUSION

The findings of this study are described as follows. The average Availability score of the seasoning powder packing machine is 80%. The performance score is 81 % on average. The quality factor is 99 % on average. The value of the spice powder packing machine's Overall Equipment Effects (OEE) is 67 percent. Further findings can be concluded that the value of availability and performance of the spice powder packing machine is below the average JIPM value. The quality value has similarities with the JIPM standard, which is 99 percent. Furthermore, the OEE score is 18 percent lower than JIPM by 85 percent. With this achievement, it is necessary to improve the processing of the FPD 93 machine powder seasoning packing.

Based on the conclusions above, some suggestions can be given as follows. Provide regular training and daily briefing to all operators so that the operator is more agile and responsive to notify the maintenance party of a problem with the machine. Increasing the level of machine inspection, the maintenance party checks the powder seasoning packing machine. The training program or training for operators should be carried out evenly because it will speed up the improvement from the personnel aspect. Further inspection of other production processes and focus on maintenance management are needed to increase productivity.

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