

Component identification the causes of machinery damage in pharmacy company using Pareto diagram

Ikhsan Siregar¹, Abdillah Arif Nasution²

¹Industrial Engineering Department, Faculty of Engineering, Universitas Sumatera Utara

²Accounting Department, Faculty of Economic and Business, Universitas Sumatera Utara

ikhsan.siregar@usu.ac.id

Abstract. Companies carry out the production process always facing the market competition. The process is done on the production floor is required to produce a quality product and capable to win the competition. Machine condition greatly affects the production process. A good machine will produce quality products, otherwise the engine in not good condition will produce a unqualified product as well. Companies engaged in the field of pharmacy manufacture often suffering machinery damage where the damage to the engine is mostly caused by the machine components of failure the function and the machine cannot run the process of operation. When there is damage to one of these machines on working hours of the machine, then the production process will be disrupted because it takes a time to replace the engine components. Therefore, it is necessary to analyze the machinery damage by identifying the critical components causes of machinery damage and corrective action is done immediately. The study was conducted using the 80/20 Pareto rule with Minitab software. The results obtained with the Pareto rule shows that the percentage of machines often damaged is a tablet machine with a percentage of 40% while the components that the main factors of damage to the tablet press machine is a component of punch and dies and pulleys.

1. Introduction

Companies carry out the production process always facing the market competition. Market competition may appear from different companies that have similar products. The process is done on the production floor is required to produce a quality product and capable to win the competition. Machine condition greatly affects the production process. A good machine will produce quality products, otherwise the engine in not good condition will produce a unqualified product as well. Machine maintenance activities are very influential on the rate of engine damage. Maintenance is one effective way to improve the reliability of a system [1]. Maintenance is an indispensable part of the business process and plays an important role in an organization's success and survival. The main purpose of maintenance is to ensure equipment functions at its original optimal level [2]. The magnitude of the maintenance level on a company becomes very important because it also affects the rate of machinery damage, the amount of machine stop time, the value of the machine effectiveness, costs and other things.

The study was conducted on a company of pharmaceutical industry produces medicine. The types of products produced by this company are varied, including tablet medicines, syrups, ointments, oral powders, external medicine powders, capsules, and powders which is



each type of product has different departments in the production process of manufacture. To produce various types of medicines, the company uses machines operates for 2 shift work with six working days in a week. The machines used by the company to produce medicines amounted to 13 machines including check weigher, mixer machine, wet granulation machine, fluid bed dryer, dry granulation machine, drying oven, lubrication machine, tablet I printing machine, tablet II printing machine, strip packing machine, count machine, blister machine, and seal packing machine.

Problems often occurs in the company is the frequency occurrence of machinery damage while doing production. When there is a damage to one of these machines in the working hours of the machine, then the production process will be disrupted because it takes time to replace the engine components. Besides that, the resulting product does not reach the quality targeted by the company. Damage that occurs on the machine is mostly caused by components of the machine fails the function and the machine cannot run the operation process [3]. This condition is danger to the company because this problem resulted in disruption of medicine distribution activity. Therefore, it is necessary to analyze the machinery damage by identifying the critical components causes of machinery damage and corrective action is done immediately.

There are many research on the machinery damage components due to lack of machine maintenance has been done before. The study was conducted in Kuwait considered analysis, modeling, and scheduling of preventive maintenance operations for fuel dispensers in a chain of gas stations [4]. Other studies were also conducted on electronic companies with a maintenance implementation for total productive maintenance [5]. The same study was conducted in Gresik by designing preventive maintenance on production machines to minimize total maintenance costs [6]. However, there has not been much research in handling the problem by identifying the machinery damage components is done especially in the pharmaceutical industry. This research was conducted to determine which is machine components becomes the main cause of machinery damage and causing breakdown machine. By identifying the components of the tablet printing machine, it will be processed of components becomes the main factor of machinery damage and more correction action can be done to avoid breakdown in production machine which is disrupt the company's production activity.

2. Methodology

The study object in this research is the machine used in pharmacy manufacturing process. Research begins by making observations to observe and see the condition of the industry directly. From the results of observation, determined the formulation of the problem in accordance to the formulation of the problem occurs in the company for research purposes can be applied. The purpose of the study determined is a solution of the existing problems. Furthermore, data collected became an input in conducting this research. The data used to identify the component causing machine malfunction is the total damage of the medicine production machine in several periods. After all the machines used are inputted, identification of the machine is most often damaged. Identification is done by looking at the percentage value at each machinery damage. The largest percentage of machinery damage will be a priority in this study.

The study was conducted in several stages. The first stage identifies the machinery damage by looking at analyzing the critical engine. Critical machines are selected based on the frequency of damage occurring during the production process. After obtains the machine

priority, the next step is to identify the machine components. This stage is done to see the critical components are the main cause of machinery damage. Identification of critical components is done using Pareto diagram. Pareto diagram is an image sorts the data clarification from left to right in order to the highest to the lowest ranking to found an important problems to be resolved as soon as possible (Ariani, 2004). This chart helps management quickly to identify the most critical areas requires a special and quick attention. The Pareto Diagram (Pareto Analysis) is a method for managing errors, problems with defects to help focus on problem solving efforts. This diagram is based on the work of Vilfredo Pareto, an economist in the 19th century. Joseph M. Juran popularized Pareto's work by stating that 80% of company problems are the result of only 20% (Heizer and Render, 2014) causes. Pareto analysis is a process of increasing the opportunity to determine which the potential opportunities is should be resolved first. Pareto analysis should be used at various stages in a quality improvement program to determine which steps are doing next (Evan, 2007). Identify critical components with pareto rules done using minitab software.

3. Result and Discussion

3.1. Machinery Damage Identification

Damage frequency data were collected based on historical maintenance data in pharmacy companies. The percentage of machinery damage can be seen in table 1.

Table 1. Historical data of machinery damage

Machine	Total	Percentage
Tablet I Printing Machine	32	21.33%
Tablet II Printing Machine	28	18.67%
Mixer Machine	15	10.00%
Wet Granulation Machine	11	7.33%
Machine	10	6.67%
Check Weigher	9	6.00%
Fluid Bed Dryer	8	5.33%
Dry Granulation Machine	8	5.33%
Lubrication Machine	7	4.67%
Strip Packing Machine	6	4.00%
Blister Machine	5	3.33%
Seal Packing Machine	4	2.67%
Count Machine	4	2.67%
Drying Oven	3	2.00%
Total		100.00%

The historical data of machinery damage is described in the form of a histogram to see which machine has the highest breakdown frequency. Making of this graph is done to describe the frequency of machinery damage occurs in the process of medicine making. The highest frequency breakdown machine graph can be seen in figure 1.

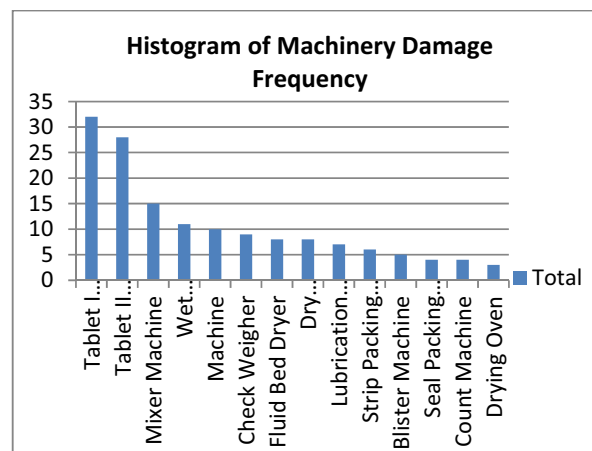


Figure 1. Histogram of Machinery Damage

Based on the histogram above shows that the tablet I and tablet II printing machine is the most frequently machinery damage with frequency as much as 32 and 28 times with the percentage of total damage to the tablet printing machine by 40% and the tablet printing machine is a priority in this research. In addition, the basic selection of the tablet printing machine is because the machine is includes in the category and reduce the amount of production if breakdown happens in the company.

3.2. Identification of Machinery Damage Components

The data frequency of critical engine component breakdown is then observed to see which is components are causes of machinery damage. The historical data of critical machine components damage can be seen in table 2.

Table 2. Frequency data of tablet printing machinery damage

Components	Total	Downtime (minute)
Punch and Dies	17	560
Pulley	12	435
Cylinder Push	5	170
Dynamo	3	100
Rail	2	60
Gramation Control Motor	1	30
Hopper	0	0
Pressure Cylinder	1	30
Bolt	1	30
Body	1	30
Solenoid	0	0
Total		1445

The selection of critical components will be the focus of research is done by the Pareto 80/20 rule. This identification is done by using minitab software. The result of component identification using minitab software can be seen in figure 2.

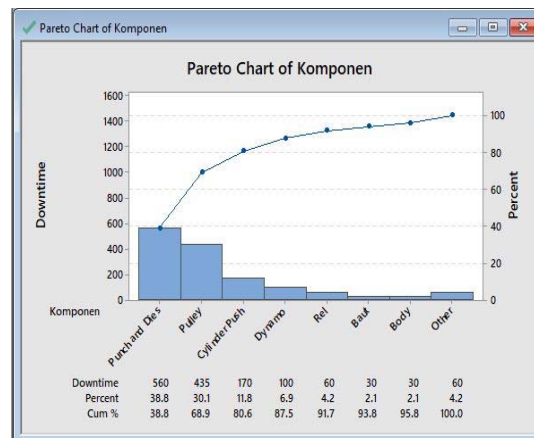


Figure 2. Pareto Chart of component damage tablet printing machine

Pareto diagrams are used to identify the most important problem. The use of Pareto 80/20 rule to the problem of production time loss due to machinery damage components. The diagram above shows that 80% production time loss caused by 20% broken components. Thus there are 2 types of critical components causing damage to the tablet printing machine are punch and dies, and pulleys.

4. Conclusion

Identification of machinery damage components is done to determine which is machine components becomes the main cause of machinery damage and machine breakdown. By identification, it is found that the percentage of machines that often experiencing damage during operation is a tablet printing machine with a percentage of 40%. While the components becomes the main factors of machinery damage of tablet printing machine is a punch and dies and pulleys component. Therefore, more analysis is required by scheduling maintenance of machine to avoid breakdown in machine production which is disrupts the company's production activity.

5. References

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