

# CHAPTER 1

## INTRODUCTION

### 1.1 Background

PT.XYZ is a manufacturing industry, which is engaged in tire re-treading and producing rubber mats. PT.XYZ has long been one of the companies that can accept used tires and Ethylene Propylene Diene Monomer (EPDM) rubber waste. PT.XYZ can receive at least 100 tons of used tires and EPDM rubber waste each month.

In addition to being one of the companies that can process used tires and EPDM rubber waste, PT.XYZ also has products from processed used tires. The processed products from used tires use a used tire shredder with the results they call "Tire Powder". The tire powder they get from processed using tires, is used for one of the manufactures of rubber mats.

PT. XYZ wants to develop another product from the processed used tires and EPDM rubber. Beginning in 2020, PT. XYZ has a used tire and EPDM rubber waste called a crusher machine that functions to chop up used tires and EPDM rubber waste. With this new crusher machine, different results from tire powder obtained from the old crusher machine owned by PT. XYZ.

Previously, the new type of crusher machine owned by PT. XYZ had already been operated and carried out production trials, but the results were still not optimal in terms of processed crusher machines, the resulting process still did not have a standard size. Also using a crusher machine result in unnecessary activity because this machine requires two operators to separate the output size obtained from the engine. The activity of separating the output apart from requiring two operators also takes a long time in separating the output from the crusher.



Figure 1.1 Waste Tire Rolls and EPDM Rubber Waste

Source: Documentation taken by researcher

Used tires are in the form of roll that has been processed by the supplier of used tires. In used tires, there are no thread and wire elements, the crusher machine owned by PT. XYZ cannot separate the wire and thread, with a lot of intensity in the used tires. A used tire roll can be seen in Figure 1.1. The tire roll is averaged at 10 kilograms per bunch. The tire roll supplier will supply used tires to PT. XYZ at least every day sent using truck type with a capacity of approximately 4 tons.

EPDM rubber waste received by PT. XYZ has been in the form of sacks containing rejected EPDM type rubber waste from various companies –which use EPDM rubber for manufacturing their products– such as rubber type parts found in automotive. For 1 sack of EPDM rubber waste received by PT. XYZ weighing an average of 10 kilograms per sack. The most widely received EPDM waste because EPDM waste it cannot be destroyed so it needs to be melted down into rubber powder or utilized.

The chopped product produced from the crusher is called a granule. Granules are small pieces of irregular shape and size, which are made from the chopping of used tires and EPDM rubber waste using five horizontally arranged blades inside the crusher. The granules will be used as one of the materials for making rubber mats that will be produced by PT. XYZ, but the granules must have a standard size due to the consideration.

The quality value of the granules itself is considered by PT. XYZ in terms of the size of the chopped crusher. The quality of the granules is said to be good if the size of the granule consists of two different sizes. However, because the size of the granules is still mixed up even

though it has been separated using a manual filter, resulting in poor quality processed products. This manual screening impacts the performance of workers, because workers must filter granules for 8 hours of work. The long work time has an impact on the results of optimal efficiency, effectiveness and work productivity. In fact, it usually shows a decrease in the quality and work results and working with prolonged time arises a tendency for fatigue (Hastuti, 2015).

The operator only inserts used tires and EPDM rubber waste. Granules referred to by PT.XYZ can be seen in Figure 1.2 below.



Figure 1.2 Output of Machine Crusher (Granules)

Source: Documentation taken by researcher

In figure 1.5 shown a flowchart of the process destroying used tires and EPDM rubber waste using a crusher from EPDM rubber waste and used tires to become granules referred to by PT. XYZ.

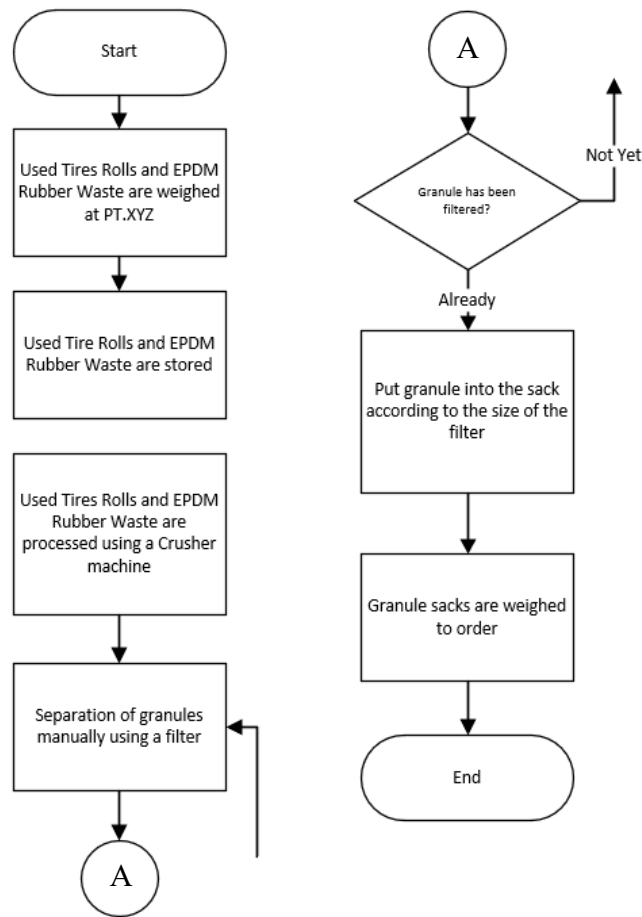


Figure 1.3 Flowchart Crusher Machine Operation

Crusher machines can be re-operated by designing tools to support optimal production processes. The design of a tool can reduce the number of operators on the crusher and the results of crusher machines that have a standard size. The standard size requested by the company is divided into two levels, namely the first level with a maximum size of granules owned by 10 mm to 8 mm and the second level with a size smaller than 8 mm.

The levels of the processed crusher machine requested by the company to separate large granules and small granules that PT.XYZ is made from the processed crusher. PT. XYZ wants a device that can separate the granules produced by the crusher without having to get help from the operator. In designing the tools at PT. XYZ, PT. XYZ itself will be a stakeholder in helping to design these tools.

## **1.2 Problem Formulation**

Based on the background of the research described earlier, the formulation of the problem identified in this study is:

How to modify the crusher to help the production process more optimally by using the Rational Product Design Method at PT. XYZ?

## **1.3 Research Objective**

The objective to be achieved by researcher based on the problem formulation is:

Provide a proposed modification of the crusher machine using the Rational Product Design method at PT.XYY to help the production process be more optimal

## **1.4 Research Limitations**

This research has limitations, so the research will become more focus and follow the research objectives. Limitation of the scope of the study is the data taken. The data are as follows:

1. This research does not do Steps 1- 4 which is The Nature of Design, Design Ability, The Design Process, New Design Procedures, and Steps 11-13 which is Improving Details, Design Strategies, and Product Development of the Rational Product Design Method because these steps have nothing to do with the Modification Design of Crusher Machines at PT. XYZ.
2. Raw material has a limit to used tires and EPDM rubber.

## **1.5 Research Benefits**

By doing this research, it is expected to provide benefits for the following parties:

1. For Company  
The results of this study are expected to help company to optimize production produced from crusher machines. Researchers also hope the company can find out the benefits of making tools for the crusher so that the company can optimize the production of this crusher machine. Also, through the results of research conducted, the authors hope that the company can implement and use the design of tools that have been made to optimize the production of this crusher machine.

## 2. For Researcher

The benefit of the researcher is being able to apply the science of product design, especially the use of the Rational Product Development method, which can then be implemented by designing auxiliary tools or additional machine crusher at PT. XYZ.

## 3. For Readers

From the results of this study, it is expected that readers can add insight related to product design, especially using the Rational Product Development method. Also, this research is expected to be able to be used as a reference for those who wish to carry out operational checks to resolve the problem.

### **1.6 Writing Systematics**

To understand this thesis report more clearly, it is done by grouping the material into several sub-chapters with systematic research as follows:

#### CHAPTER 1: INTRODUCTION

This chapter describes general information, namely the background of the study, the formulation of the problem, the objectives and benefits of the study, the scope of the study, the time and place of research, research methodology, and research systematic.

#### CHAPTER 2: LITERATURE STUDY

This chapter contains theories taken from several book excerpts, which are in the form of definitions. This chapter also explains the basic concepts of the Rational Product Development method and others basic concept and their definitions related to the system discussed.

#### CHAPTER 3: RESEARCH METHODOLGY

In this chapter explains the steps in research in detail starting from the identification of the formulation of the problem, the stage of data collection, data processing and the final stage of the analysis and conclusions.

#### CHAPTER 4: RESULT AND DISCUSSION

This chapter contains collected data and processed data that support research

#### CHAPTER 5: CONCLUSION

This chapter contains conclusions and suggestions relating to the analysis and optimization of the system based on those described in the previous chapters.